

Wyoming Region 5 Hazard Mitigation Plan 2023-2028



Assistance provided by:



January 2023

Wyoming Region 5

Fremont County

Sublette County

Wind River Reservation

Regional Hazard Mitigation Plan

2023-2028

Developed by Fremont and Sublette Counties and the Wind River Reservation including the Northern
Arapaho and Eastern Shoshone Tribes

With professional planning assistance from

WSP USA Environment & Infrastructure Inc.

Hazard Mitigation and Emergency Management Program

Executive Summary.....	ii
1 Introduction	1-1
1.1 Purpose	1-1
1.2 Background and Scope.....	1-1
1.3 Plan Organization.....	1-2
1.4 Multi-Jurisdictional Planning	1-2
2 Community Profile.....	2-1
2.1 Geography and Climate.....	2-1
2.2 Population.....	2-4
2.3 Development Trends	2-4
2.4 Economy	2-4
3 Planning Process.....	3-6
3.1 Background on Mitigation Planning in Region 5	3-6
3.2 What's New in the Plan Update	3-8
3.3 Government Participation.....	3-10
3.4 The 10-Step Planning Process	3-11
4 Hazard Analysis and Risk Assessment	4-1
4.1 Hazard Identification	4-1
4.2 Hazard Profiles	4-6
5 Mitigation Strategy	5-1
5.1 Mitigation Strategy: Overview	5-1
5.2 Goals and Objectives	5-1
5.3 Identification and Analysis of Mitigation Actions	5-4
5.4 Mitigation Action Plan	5-6
6 Plan Adoption, Implementation, and Maintenance	6-1
6.1 Formal Adoption	6-1
6.2 Implementation	6-1
6.3 Plan Maintenance.....	6-2

Jurisdictional Annexes

Fremont County Annex

Sublette County Annex

Appendices

Appendix A Planning Process Documentation

Appendix B Adoption Resolutions and Plan Approval

Executive Summary

This plan is the product of a 2022 planning process undertaken by the two counties and two tribes in Wyoming Office of Homeland Security Region 5 – Fremont and Sublette Counties and the Northern Arapaho and Eastern Shoshone tribes of the Wind River Reservation. The purpose is to meet the requirements of the Disaster Mitigation Act of 2000 (PL 106-390), and thereby maintain continued eligibility for certain Hazard Mitigation – or disaster loss reduction – programs from the Federal Emergency Management Agency (FEMA). This plan updates the previous regional hazard mitigation plan for Fremont and Sublette Counties and the Wind River Reservation inclusive of both tribes that was developed in 2017.

The process followed a methodology that adheres to FEMA guidance for local and tribal hazard mitigation plans. It consisted of two levels of planning teams; a steering committee/coordinating planning team comprised of the Emergency Management Coordinators, and three local Hazard Mitigation Planning Committees – one for each county and one inclusive of both tribes. Every municipality within each county was invited to participate.

The planning process examined the recorded history of losses resulting from natural hazards, and analyzed the future risks posed to each county by these hazards. A hazard identification and risk assessment was updated for the following hazards: avalanche, dam failure, drought, earthquake, expansive soils, extreme cold, flood, hailstorm, hazardous materials, high winds, landslide, lightning, mine subsidence, tornadoes, severe winter storms and wildfire. The hazards were assessed for geographic extent, potential magnitude probability, vulnerability and given a rating for overall significance. Drought, wildfire, floods and winter storms tend to cause the most damage or economic loss in the Region.

The plan's mitigation strategy includes goals for each county and the Reservation in the planning area. The plan also puts forth county-specific recommendations for mitigation, based on the risk assessment, that are designed to reduce future losses in each county, the Reservation, and the Region.

1 Introduction

1.1 Purpose

The counties and participating jurisdictions of Wyoming Region 5 including Fremont and Sublette Counties and the Eastern Shoshone and Northern Arapaho Tribes of the Wind River Reservation prepared this regional hazard mitigation plan to guide hazard mitigation planning and to better protect the people and property of the planning area from the effects of hazard events. This plan demonstrates the region's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan also maintains the planning area's eligibility for certain federal disaster assistance under the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grant programs including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) and Building Resilient Infrastructure and Communities (BRIC) program, as well as to make the region more disaster resistant. This plan demonstrates the region and each county's and tribe's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources.

1.2 Background and Scope

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of \$6 in avoided future losses in addition to saving lives and preventing injuries (Natural Hazard Mitigation Saves, 2019 Report).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are developed, prioritized, and implemented. This plan documents the planning region's hazard mitigation planning process, identifies relevant hazards and risks, and identifies the strategies that each participating jurisdiction will use to decrease vulnerability and increase resiliency and sustainability.

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007 (hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA)). While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the planning area is subject to many kinds of hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The jurisdictions in the planning area have been affected by hazards in the past and are thus committed to reducing future disaster impacts and maintaining eligibility for federal funding.

1.3 Plan Organization

The Wyoming Region 5 Regional Hazard Mitigation Plan is organized in alignment with the DMA planning requirements and the FEMA plan review crosswalk as follows:

- Chapter 1: Introduction
- Chapter 2: Community Profile
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption, Implementation, and Maintenance
- County and Reservation Annexes
- Appendices

The counties of Fremont and Sublette and the Wind River Reservation each have their own annex, which provides a more detailed assessment of each jurisdiction's unique risks as well as their mitigation strategy to reduce long-term losses. Each annex contains the following:

- Community profile summarizing geography and climate, history, economy, and population
- More detailed hazard vulnerability information and unique risks by jurisdiction, where applicable, for geographically specific hazards
- Hazard map(s) at an appropriate scale for the jurisdiction, if available
- Number and value of buildings, critical facilities, and other community assets located in hazard areas, if available
- A capability assessment describing existing regulatory, administrative, and technical resources
- Mitigation actions specific to the county, municipalities, and tribes

1.4 Multi-Jurisdictional Planning

This plan was prepared as a regional, multi-jurisdictional plan. The planning region is comprised of two counties and one reservation with two tribes in Wyoming Region 5 (Region), established by the Wyoming Office of Homeland Security (WOHS); the region includes Fremont and Sublette counties and the Northern Arapaho and Eastern Shoshone tribes of the Wind River Reservation. All local units of government in each county were invited to participate in the planning process. The decision whether or not to participate in this process was a local decision, based on local community needs. Communities have the options to not prepare a plan, to prepare a stand-alone plan for their jurisdiction, or to participate in a multi-jurisdiction or county-wide plan. All of the counties and municipalities in the Region, and both tribes participated in and adopted the plan in 2017. The following table lists entities that have opted to participate in this effort and are seeking FEMA approval of the 2022 version of this plan. There were some changes in participation since the 2017 plan, as some municipalities were provided the opportunity to participate but declined. Additional details about participation can be referenced in Chapter 3 and the jurisdictional annexes.

Table 1-1 Multi-Jurisdictional Participation 2022

Jurisdiction	Participation Status 2022
Fremont County	Continuing from 2017 update
Town of Dubois	Continuing from 2017 update
Town of Shoshoni	Not participating
Town of Hudson	Continuing from 2017 update
Town of Pavillion	Not participating
City of Lander	Continuing from 2017 update
City of Riverton	Not participating
Sublette County	Continuing from 2017 update
Town of Pinedale	Continuing from 2017 update
Town of Marbleton	Continuing from 2017 update
Town of Big Piney	Not participating
Hoback Ranches Special Improvement District	New to plan in 2022 update
Wind River Reservation	
Northern Arapaho Tribe	Continuing from 2017 update
Eastern Shoshone Tribe	Continuing from 2017 update

2 Community Profile

This section provides a brief overview of the geography of the planning area. Additional geographic profiles of the participating jurisdictions are provided in the annexes.

2.1 Geography and Climate

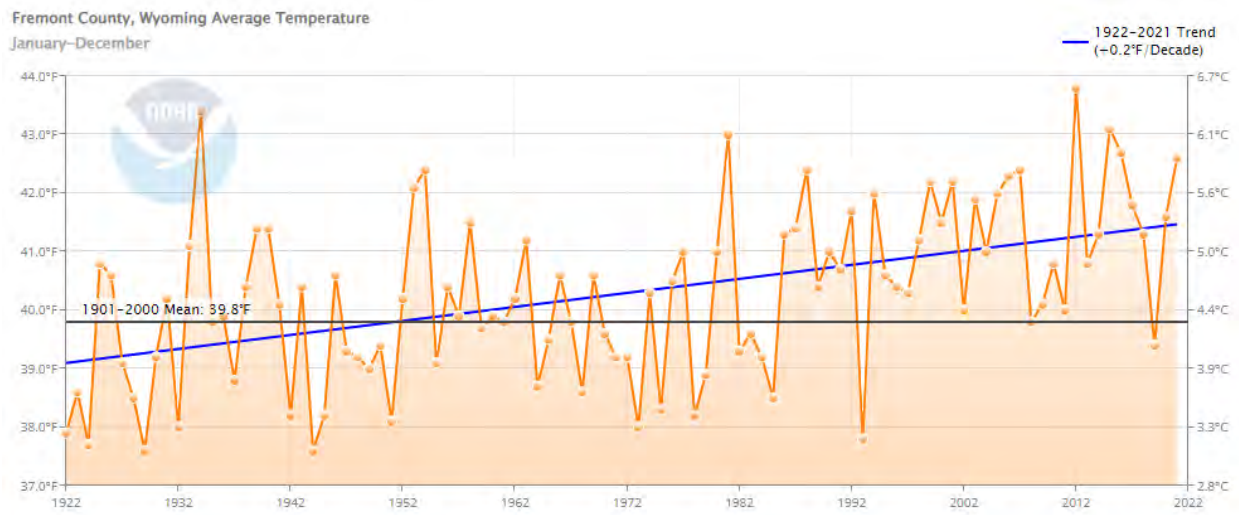
Wyoming Region 5 is comprised of two counties in central Wyoming on the eastern and western slopes of the Wind River Mountains. Counties in the Region include Fremont and Sublette. In addition, Wyoming's only native American reservation, the Wind River Reservation, covers a portion of Fremont County and extends into Hot Springs County (which is located in Wyoming Region 6).

The region is very mountainous. Sublette County is enclosed by the Wyoming Range to the west, and the Gros Ventre Range in the northwestern County. The Wind River Reservation and Fremont County are bound by the Wind River Range, the Washakie Range and Owl Creeks, Wyoming Range, and the Gros Ventre Range in the northwestern County and southern Big Horn Mountains on the north, the Casper Arch, and the Granite Mountains on the south.

The two counties cover 14,148 square miles, while the Wind River Reservation covers 3,500 square miles, most of which is in Fremont County. More than 70 percent of the region's land area (5.46 million acres) is owned by the federal government. Elevations range between 3,000 and 13,904 ft. Located in Fremont County, Gannett Peak is the highest point in the state of Wyoming. The major rivers in the region include the Green River, Big Wind River, Little Wind River, and the Popo Agie River. Major roadways include Highway 26, Highway 20, Highway 191, Highway 287, Highway 351, and Highway 789. A base map of the planning region is illustrated in Figure 2-3.

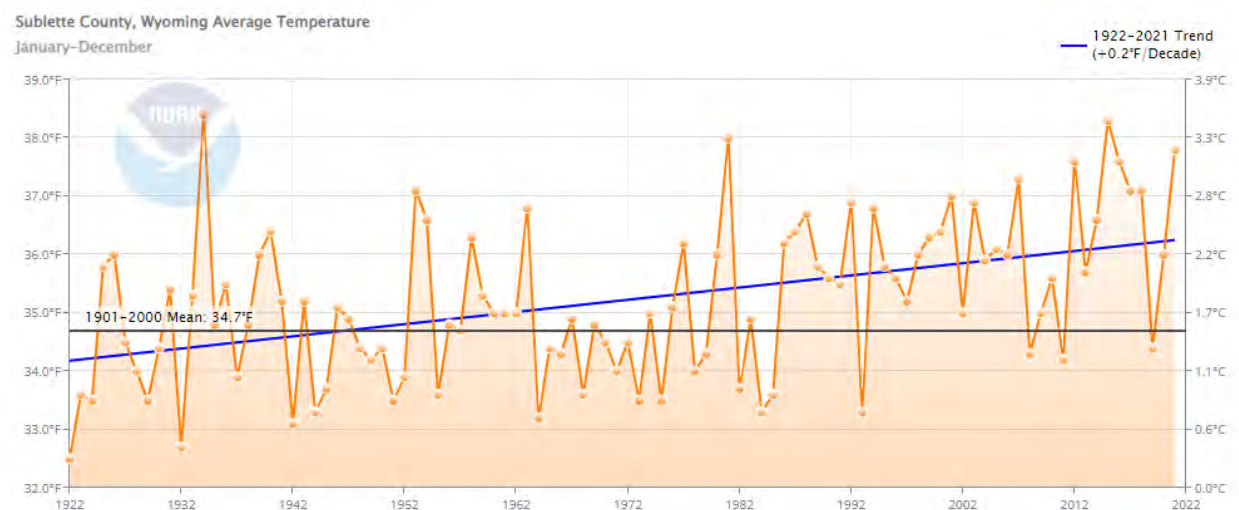
The climate of the region varies depending on location and time of year. The National Centers for Environmental Information (NCEI) reports that temperature extremes range from over 100 degrees in the summer, to as low as -31 degrees in the winter. July is the hottest month in Region 5, with an average monthly high of 78 F, and December is the coldest month, with average monthly lows of 4.2 degrees. Fremont County has slightly warmer average temperatures than Sublette County. The annual mean temperature in Region 5 has been increasing slightly over the last century, by 0.2 degrees F per decade, as seen in the figures below.

Figure 2-1 Fremont County Average Annual Temperatures 1922-2021



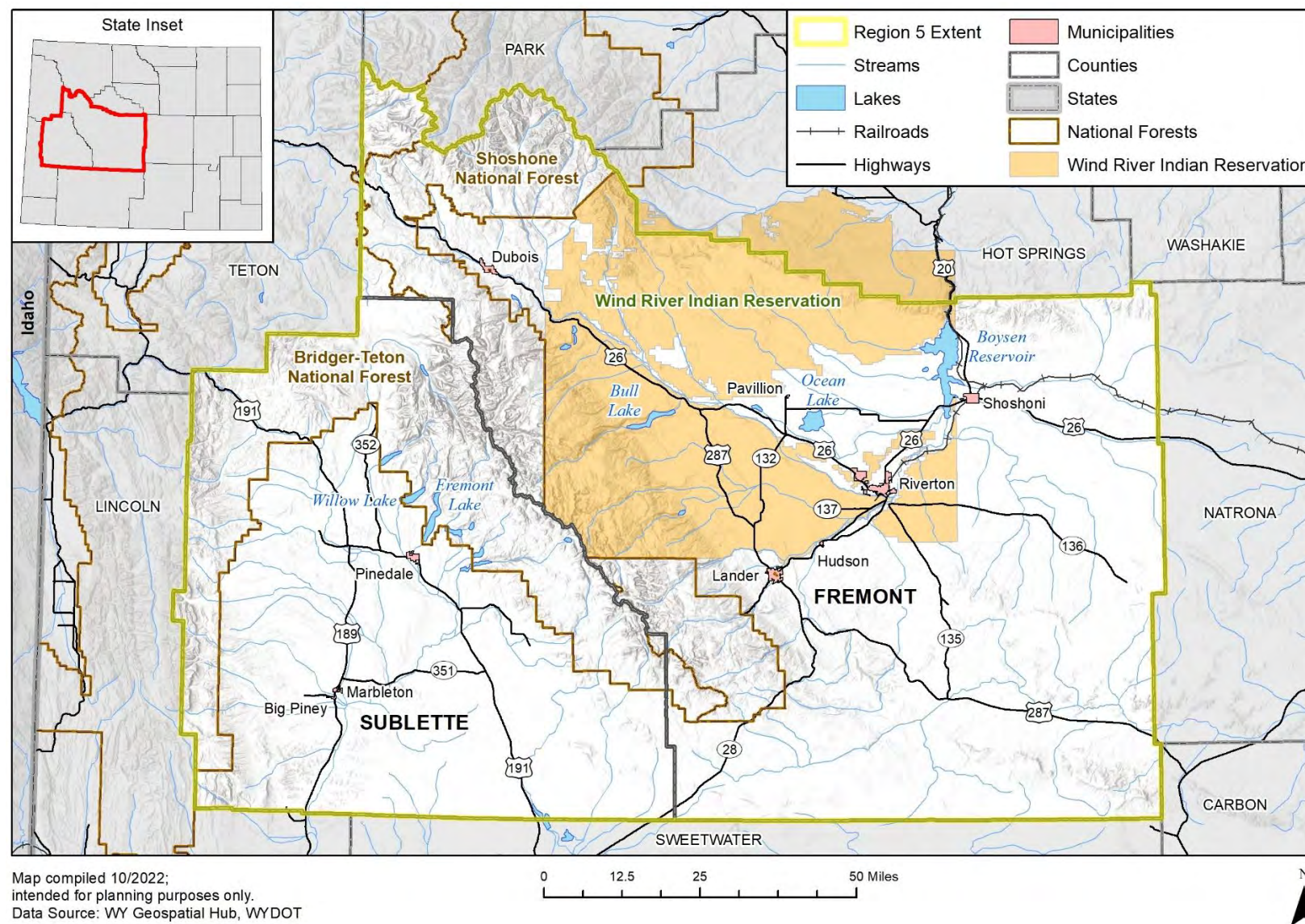
Source: NCEI Climate at a Glance

Figure 2-2 Sublette County Average Annual Temperatures 1922-2021



Source: NCEI Climate at a Glance

The region is semi-arid, and averages only 13 to 14 inches of rainfall annually. The month of May has highest average recorded rainfall in the region. Although not enough precipitation falls in the warmer months for adequate natural growth of crops, a significant amount of precipitation is accumulated in the mountains in the form of snow. Total annual snowfall also varies considerably. In areas of the Basin where elevations range from 5,000 to 6,000 feet, annual averages can be 20 to 40 inches. In the higher regions, snowfall averages often reach 100 inches. Weather Trend data reported that Sublette County receives around 62.0 inches of snowfall annually, and Fremont County receives an average of 38.9 inches.

Figure 2-3 Wyoming Region 5 Base Map

2.2 Population

Table 2-1 describes the population and estimated population change for the planning region as a whole and individual county, and the reservation. Data in the table is based on the American Community Survey data from the US Census Bureau. Overall, Region 5 is decreasing in population, but percent decrease varies by county within the region. Sublette County has decreased in population significantly over the past decade, and Fremont County has decreased as well. Wind River Reservation has grown slightly in population.

Table 2-1 Region 5 Population Change

	2010 Census	2015 Estimate	2016 Estimate	2017 Estimate	2018 Estimate	2019 Estimate	2020 Census	% Change 2010 to 2020
Region 5	76,959	77,324	77,007	76,462	76,113	75,514	74,704	-2.9%
Fremont	40,222	40,261	40,250	39,865	39,656	39,467	39,234	-2.5%
Sublette	10,247	10,064	9,997	9,778	9,827	9,867	8,728	-14.8%
Wind River Reservation	26,490	26,999	26,760	26,819	26,630	26,180	26,742	0.95%

Source: US Census Bureau ACS 5-year Estimates

2.3 Development Trends

While the population of Region 5 as a whole has been slowly declining over the past 5 years, the Wyoming Department of Administration and Information projects that statewide the population will grow slightly through the year 2040, as well as the overall population of Region 5. There was not information available for population growth projections for the Wind River Reservation. Below is listed the total projected 2040 populations of each county within Region 5:

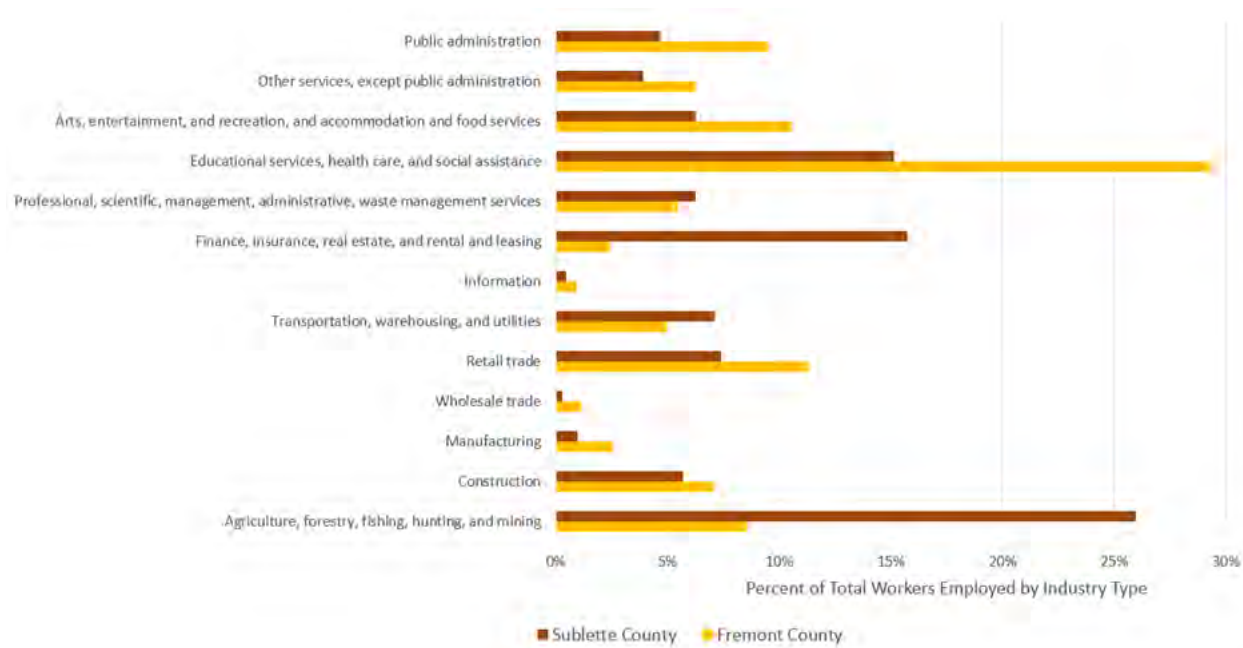
- Fremont County: **40,180**
- Sublette County: **10,470**

According to the Wyoming Department of Administration and Information, both Fremont County and Sublette County will grow in overall population over the next two decades, which will raise the total population of the Region slightly over what it is today.

Building trends include an uptick in second home development in Sublette County noted by the CPT; many of these homes are in Wildland Urban Interface areas. There are also some development pressures near floodplains in Sublette County, including oil and gas extraction-related development.

2.4 Economy

According to the Wyoming County Commissioners Association and the U.S. Census Data 2020, jurisdictions included within Region 5 are largely based in the mining and agriculture industries. In 2020, the U.S. Census Bureau reported that "agriculture, forestry, fishing, hunting, and mining" accounted for 26% of total employment in Sublette County and 9% percent of employment in Fremont County. The U.S. Census Bureau also reported "educational services, health care, and social assistance" as a significant industry employer in Region 5, accounting for 29% of total employment in Fremont County and 15% in Sublette County. Due to the large and expansive nature of the counties, and the wide geographic distribution of the population, local and tribal governments also represent a significant portion of regional employment. Recreation and tourism industries and activities are also an important economic base for the Region. Figure 2-4 displays a breakdown of the total employment by industry in each county.

Figure 2-4 Region 5 Industry Type by Percentage of Total Workers Employed

Data Source: U.S. Census, 2020, Figure by WSP

Mineral Answers data reported that Wyoming is the #9 oil and gas producing state in the United States, with 140,361 wells that have been drilled between 1978 and 2022. Fremont County and Sublette County have been ranked as two of the highest producing barrel of oil equivalents (BOE) in the state. Fremont County has drilled 2,038 wells since 1978 and is ranked #37 nationally for gas and oil energy production. Sublette County has drilled 7,905 wells and is ranked #11 nationally for gas and oil energy production.

Agriculture plays a major role in Fremont County. According to the USDA 2017 Census of Agriculture, there are 1,152 individual farms in Fremont County, totaling 1,165,154 acres of farmland. In 2017 these farms produced a combined market value of products totaling \$82,427,000. Sublette County also reported similar figures to the 2017 Census of Agriculture. According to the census, there were 402 farms in Sublette County comprising 546,353 acres of farmland. These farms together produced \$47,872,000 in market value of products sold in 2017.

3 Planning Process

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

- 1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
- 2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and*
- 3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

- i. Tribal Requirement §201.7(c)(1): Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved. This shall include:*
- ii. An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval, including a description of how the Indian tribal government defined "public;"*

As appropriate, an opportunity for neighboring communities, tribal and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process

3.1 Background on Mitigation Planning in Region 5

The 2017 Region 5 Hazard Mitigation Plan was the first regional hazard mitigation plan for Fremont County, Sublette County, and the Northern Arapaho and Eastern Shoshone tribes of the Wind River Reservation. The plan underwent a comprehensive update in 2022 to comply with the five-year update cycle required by the DMA 2000 and to reflect mitigation priorities for the five-year span between 2023-2028.

Prior to 2017, the counties and tribes had adopted jurisdictional-specific hazard mitigation plans over the years. The following is a short description of those efforts by the counties and tribes.

Fremont County. The Fremont County components of this Regional Plan have their roots in meetings and activities that occurred during the 2012 plan development. However, the initiation of disaster mitigation planning began with Project Impact more than a decade prior. In June 1998, Fremont County became the first community in Wyoming to be designated as a Project Impact community. The program focused on creating disaster-resistant communities and improving the emergency response to incidents in the county. Project Impact was active in Fremont County from 1998 through September 2000. The process and findings that resulted from the development of Project Impact catalyzed the creation of the 2004 Fremont County Land Use Plan, and ultimately spurred ideas and activities that resulted in the first draft of the Fremont County/Municipal Multi-Hazard Mitigation Action Plan.

Sublette County. Sublette County began the local hazard mitigation planning process in the fall of 2005. The Local Emergency Planning Commission (LEPC) reviewed and evaluated existing information, while

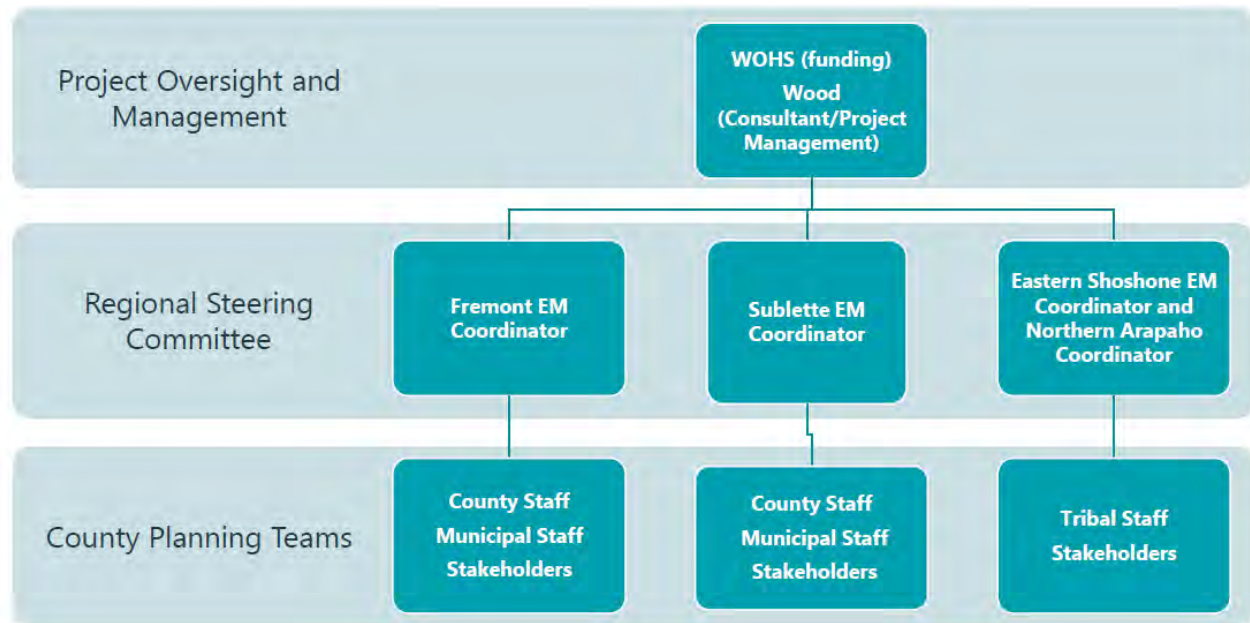
clarifying the purpose and the process of creating a County Hazard Mitigation Plan. Between September 2005 and May 2006, the commission met eight times to refine the initial draft. Additional assistance was provided by the Wyoming Office of Homeland Security and Bear West consulting. The Plan was ultimately approved in August 2008.

Wind River Reservation. On July 1, 2004, both the Eastern Shoshone Business Council and the Northern Arapaho Business Council signed resolutions to officially recognize the creation of their respective Emergency Management Committees via Resolution Number 2004-8777. These committees provided input to a 2006 Multi-Hazard Mitigation Plan, with assistance from a consultant. It was the first document of its type to exist for the Wind River Reservation but was never formally adopted by either tribe.

Regional Planning. In Wyoming, the WOHS utilizes a regional support structure to assist the counties with all aspects of emergency management, including planning. Each county has an emergency management coordinator. The counties in the Wind River basin, Fremont and Sublette, and the Wind River Reservation comprise Region 5. In 2016, the WOHS began the process of initiating the development of regional hazard mitigation plans statewide. This initiative recognized that the process of facilitating and developing or updating multi-jurisdictional hazard mitigation plans compliant with the DMA 2000 is often beyond local and tribal capabilities and expertise. Instead of each county and tribe hiring consultants, the WOHS took the lead in procuring and funding a professional hazard mitigation planning consultant through a competitive bid process. WSP USA Environment & Infrastructure Inc. (WSP) of Denver, Colorado was selected in late 2016 and 2019 (under a multi-year, multiple region contract) to provide assistance to the Region.

Prior to initiating the development of this regional multi-jurisdictional Hazard Mitigation Plan in 2022, a substantial coordination effort took place to ensure the participation of both counties and the reservation within Region 5. Each jurisdiction designated the Emergency Management Coordinator as the primary point of contact. Each Coordinator was required to undertake a coordination role within their respective counties to help fulfill DMA planning requirements. The county Emergency Management Coordinators then contacted each of the incorporated communities, offering them the opportunity to participate in the development of the Region 5 Hazard Mitigation Plan. Most incorporated communities within the counties, the tribes, as well as a special improvement district, chose to participate in the development of this Regional Plan. A graphic illustrating the Hazard Mitigation Planning Committee (HMPC) / regional planning framework is shown below.

Figure 3-1 Region 5 Hazard Mitigation Planning Committee Framework



Each Emergency Management Coordinator led Hazard Mitigation Planning Committees (HMPCs), also called County Planning Teams (CPTs) working in concert with the hazard mitigation planning consultant. As the planning consultant, WSP's role was to:

- Provide guidance on a planning organization for the entire planning area representative of the participants;
- Ensure the plan meets all of the DMA requirements as established by federal regulations, following FEMA's most recent planning guidance;
- Facilitate the entire planning process;
- Identify the data requirements that the participating counties, tribes and municipalities could provide, and conduct the research and documentation necessary to augment that data;
- Develop and help facilitate the public input process;
- Produce the draft and final plan documents; and
- Ensure acceptance of the final Plan by WOHS and FEMA Region VIII

3.2 What's New in the Plan Update

DMA Requirement §201.6(d)(3):

A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

The updated HMP complies with Federal Emergency Management Agency (FEMA) guidance for Local Hazard Mitigation Plans. The update followed the requirements noted in the Disaster Mitigation Act (DMA) of 2000 and FEMA's 2013 Local Hazard Mitigation Planning Handbook.

This HMP update involved a comprehensive review and update of each section of the 2017 plan and includes an assessment of the progress in evaluating, monitoring, and implementing the mitigation strategy

outlined in the previous plan. The planning process provided an opportunity to review jurisdictional priorities related to hazard significance and mitigation action, and revisions were made where applicable to the plan. Only the information and data still valid from the 2017 plan was carried forward as applicable into this HMP update.

3.2.1 Plan Section Review and Analysis – 2022 Update

During the 2022 plan update, the HMPC updated each of the sections of the previously approved plan to include new information. WSP developed a summary of each section in the plan and guided the Regional, Tribal and County Planning Teams through the elements that needed updating during the kickoff webinar in February 2022. This included analyzing each section using FEMA’s local plan update guidance (2013) to ensure that the plan met the latest requirements. In addition, the FEMA Local Mitigation Plan Review Tool that was provided with the approval of the 2017 version of this plan was referenced, in particular the 2017 FEMA comments on opportunities for improvement, were considered and addressed in the 2022 update. A summary of the changes in this plan update is highlighted in the table below.

Table 3-1 Wyoming Region 5 Hazard Mitigation Plan Update Highlights

Plan Section	Summary of Plan Review, Analysis, and Updates
0. Executive Summary	Revised to reflect 2022 planning process
1. Introduction	Revised to reflect updated plan and 2022 planning process
2. County Profile	Updated with recent census data and current economy description Updated land use and development trends
3. Planning Process	Describes and documents the planning process for the 2022 update, including coordination among agencies Describes how 2022 plan was integrated with/into other planning efforts Removed 2017 planning process info Describes changes to jurisdictional participation Describes 2022 public participation process Describes the Hazard Mitigation Planning Committee (HMPC) including Regional Steering Committee and County Planning Teams (CPT) Describes the 10-step process followed for the update
4. Hazard Identification and Risk Assessment	Added epidemic/pandemic hazards Considerations on future climate impact information has been added to each hazard profile Updated list of disaster declarations to include recent data Updated tables to include recent National Center for Environmental Information data. Updated past occurrences for each hazard to include recent data. Updated critical facilities identified from the 2017 plan. Updated growth and development trends to include recent Census and local data sources. Updated property values for vulnerability and exposure analysis, using updated building information based on assessor’s data. Updated estimate flood losses using the latest Digital Flood Insurance Rate Map (DFIRM) and assessor’s data. Updated National Flood Insurance Program (NFIP) data and Repetitive Loss structure data from the previous plan. Incorporated new hazard loss estimates since 2017, as applicable. Used updated GIS inventory data for vulnerability analysis Updated information regarding specific vulnerabilities to hazards, including maps and tables of specific assets at risk, specific critical facilities at risk, and specific populations at risk. Updated maps in plan where appropriate.

Plan Section	Summary of Plan Review, Analysis, and Updates
5. Mitigation Strategy	Indicated what actions have been implemented that may reduce previously identified vulnerabilities. Updated mitigation strategy based on the results of the updated risk assessment, completed mitigation actions, and implementation obstacles and opportunities since the completion of the 2017 plan. Reviewed and updated goals and objectives based on HMPC input. Included updated information on how actions are prioritized, or how priorities changed. Reviewed mitigation actions from the 2017 plan and developed a status report for each; identified if actions have been completed, deleted, or deferred/carried forward. Updated priorities on actions. Identify examples of successful implementation to highlight positive movement on actions identified in 2017 plan. Identified new mitigation actions proposed by each CPT with more detail on implementation than the previous plan. Developed a summary table of mitigation actions for all participating jurisdictions.
6. Adoption, Implementation and Maintenance	Update to reflect 2022 process. Reviewed and updated procedures for monitoring, evaluating, and updating the plan. Revised to reflect current methods. Updated the system for monitoring progress of mitigation activities by identifying additional criteria for plan monitoring and maintenance. Updated process for incorporation of the HMP into existing mechanisms
Jurisdictional Annexes	Fremont County Sublette County Wind River Reservation (Eastern Shoshone and Northern Arapaho tribes) Updated previous participants' annexes with recent Census data. Updated past event history and hazard loss estimates. Updated capabilities assessments. Added new maps and updated old maps as needed. Updated mitigation actions from 2017 and added new mitigation actions; standardized the format of mitigation actions across the annexes. Updated and standardized format of annexes:
Appendices	Appendix A Planning Process Documentation Appendix B Adoption Resolutions and Plan Approval

3.3 Government Participation

The Disaster Mitigation Act (DMA) planning regulations and guidance stress that each local and tribal government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the Hazard Mitigation Planning Committee (HMPC),
- Detail areas within the planning area where the risk differs from that facing the entire area,
- Identify specific projects to be eligible for funding, and
- Have the governing board formally adopt the plan.

For the Region 5 Multi-Hazard Mitigation Plan's HMPC, "participation" meant:

- Providing input by attending and participating in HMPC meetings, separate side-bar meetings, or email and phone correspondence

- Establishing/reconvening a local steering committee;
- Providing available data requested by the HMPC coordinator and planning consultant;
- Providing/updating the hazard profile and vulnerability details specific to jurisdictions;
- Developing/updating the local mitigation strategy (action items and progress);
- Advertising and assisting with the public input process;
- Reviewing and commenting on plan drafts; and
- Coordinating the formal adoption of the plan by the governing boards.

This Regional Plan includes the participation of all counties and most of the municipalities in Region 5 as noted in Chapter 1 and detailed further in Section 3.4.1. There was participation of the Northern Arapaho and Eastern Shoshone tribes, but personnel changes caused delays during the planning process. However, the tribes were able to coordinate directly with the planning consultant in early 2023 in order for their annex to be finalized in 2023 along with the rest of the regional HMP. Documentation of participation is included in Appendix A in the form of meeting sign in sheets, meeting summaries, and more.

3.4 The 10-Step Planning Process

WSP established the planning process for the Region 5 plan using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

- 1) Organize Resources
- 2) Assess Risks
- 3) Develop the Mitigation Plan
- 4) Implement the Plan and Monitor Progress

Into this four-phase process, WSP integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and Flood Mitigation Assistance (FMA) programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program, Pre-Disaster Mitigation program, Community Rating System (CRS), Flood Mitigation Assistance Program, and flood control projects authorized by the U.S. Army Corps of Engineers. FEMA's March 2013 Local Mitigation Planning Handbook recommends a nine-task process within the four-phase process. Table 3-2 summarizes the four-phase DMA process, the detailed CRS planning steps and work plan used to develop the plan, the nine handbook planning tasks from FEMA's 2013 Local Mitigation Planning Handbook, and where the results are captured in the Plan. Tribal elements of the Regional HMP were designed to be fully compliant with the requirements of 44 CFR 201.7 as detailed in FEMA's 2019 Tribal Multi-Hazard Mitigation Planning Guidance. The sections that follow describe each planning step in more detail.

Table 3-2 Mitigation Planning Process Used to Develop the Regional Hazard Mitigation Plan

FEMA 4 Phase Guidance	Community Rating System (CRS) Planning Steps (Activity 510) and WSP Work plan Steps	FEMA Local Mitigation Planning Handbook Tasks (44 CFR Part 201)	Location in Plan
Phase I: Organize Resources	Step 1. Organize Resources	1: Determine the Planning Area and Resources	Chapters 1, 2 and 3
		2: Build the Planning Team 44 CFR 201.6(c)(1)	Chapter 3, Section 3.4.1
	Step 2. Involve the public		

FEMA 4 Phase Guidance	Community Rating System (CRS) Planning Steps (Activity 510) and WSP Work plan Steps	FEMA Local Mitigation Planning Handbook Tasks (44 CFR Part 201)	Location in Plan
		3: Create an Outreach Strategy 44 CFR 201.6(b)(1)	Chapter 3, Section 3.4.1
	Step 3. Coordinate with Other Agencies	4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3)	Chapter 3, Section 3.4.1 and annexes
Phase II: Assess Risks	Step 4. Assess the hazard	5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii)	Chapter 4 and annexes
	Step 5. Assess the problem		Chapter 4 and annexes
Phase III: Develop the Mitigation Strategy	Step 6. Set goals	6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)	Chapter 5, Section 5.2
	Step 7. Review possible activities		Chapter 5, Section 5.3
	Step 8. Draft an action plan		Chapter 5, Section 5.4 and annexes
Phase IV: Adopt and Implement the Plan	Step 9. Adopt the plan	8: Review and Adopt the Plan	Chapter 6
	Step 10. Implement, evaluate, revise	7: Keep the Plan Current	Chapter 6
		9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)	Chapter 6

3.4.1 Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

With each jurisdiction's commitment to develop a Regional Plan, WSP worked with WOHS and each County and Tribal Coordinator to establish the framework and organization for the process. Organizational efforts were initiated with each county to inform and educate the plan participants of the purpose and need for the regional hazard mitigation plan. During the development of this Regional Plan, the planning process was directed through a regional planning committee comprised of Fremont County Emergency Management, Sublette County Emergency Management, the Wind River Reservation including the tribal Emergency Management Coordinator for the Northern Arapaho Tribe and the Public Health Response Coordinator for the Eastern Shoshone tribe, and participating jurisdictions. The planning consultant held an initial conference call using Microsoft Teams (Teams) to discuss the organizational aspects of the planning process with the emergency management coordinators. Using FEMA planning guidance, representative participants for each county's HMPC base membership were established, with additional invitations extended as appropriate to other federal, state, tribal, and local stakeholders and the public throughout the planning process. The list of agencies and individuals invited to participate is provided in the following table. More details with documentation of participation included are in Appendix A.

Early in the planning process a coordination conference occurred prior to the planning process kick-off to ensure tribal mitigation planning requirements (44 CFR 201.7 as detailed in FEMA's 2019 Tribal Multi-Hazard Mitigation Planning Guidance) were understood. Participants on this call included FEMA Region VIII, the Northern Arapaho and Eastern Shoshone tribes, WSP and the Wyoming Office of Homeland Security.

Table 3-3 Regional HMPC Members and Stakeholders by Jurisdiction

Jurisdictions and Stakeholders	Representatives
Fremont County	
Fremont County	County Emergency Management Coordinator
	County EMA Administrative Assistant
	Fremont County Sheriff's Office
	Fremont County Emergency-911 Manager
	Fremont County Fire Warden
	Fremont County Transportation Superintendent
	Fremont County Assessor
	Director of Planning
	LEPC Chairman
	LEPC Vice Chairman
Town of Dubois	Mayor
	Director of Public Works
	Chief of Fire Department
Town of Hudson	Mayor
	Clerk
Town of Lander	Public Works
	Fire Administrator
	Chief of Police
State and Other Local Agencies	Wyoming Office of Homeland Security
	Wyoming Department of Transportation
	Wyoming State Forestry
	Fremont County Firewise
	University of Wyoming Extension Office
	School District #1
	School District #2
	School District #6
	School District #14
	School District #21
	School District #24
	School District #25
	School District #38
	Popo Agie Conservation District
	Lower Wind River Conservation District
	Fremont County Association of Governments
Federal Agencies	NOAA
	Bureau of Reclamation
	Bureau of Land Management
	US Geological Survey
	US Forest Service
Private Industry/Stakeholders	High Plains Power
	Rocky Mountain power
	Black Hills Energy/Source Gas
	Fremont County Solid Waste
	LeClair Irrigation
	Midvale Irrigation District

Jurisdictions and Stakeholders	Representatives
	Riverton Valley Irrigation District
	Farm Bureau
	Wind River Visitor Council
Sublette County	
Jurisdictions and Stakeholders	Representatives
Sublette County	Sublette County Sheriff's Office
	Sublette County Public Health
	Sublette County Fire Warden
	Sublette County Undersheriff
	Sublette County Environmental Health
	Sublette County Commissioners
Town of Pinedale	Pinedale Assistant Mayor
	Sublette County EMS Pinedale
	Pinedale Volunteer Fire Department
Town of Marbleton	Marbleton Public Works
Hoback Ranches Special Improvement District	Chairman
State Agency Stakeholders	Wyoming Office of Homeland Security
	Wyoming Highway Patrol
Federal Agencies Stakeholders	BLM
	US Forest Service
Wind River Reservation	
Eastern Shoshone Tribe	Tribal Public Health Response Coordinator
	Eastern Shoshone Housing Authority
	Eastern Shoshone Tribal Health
	Tribal Water Engineer
	Tribal Planning
	Fort Washakie School/Fire
Northern Arapaho Tribe	Tribal EMA Coordinator
	Northern Arapaho Tribal Housing
	Northern Arapaho CHR
	Northern Arapaho Utilities
	Northern Arapaho Public Relations
	Northern Arapaho Tribe Historic Preservation Office
	Facilities and Maintenance
	Environmental
Joint Tribal	Shoshone and Arapaho Transportation Department
Federal Agencies Stakeholders	Bureau of Indian Affairs – Wind River Agency Law Enforcement
	BIA- Wind River Police Department
	Bureau of Land Management
	Indian Health Services (IHS)
	FEMA Region VIII
State or Local Agencies Stakeholders	Wyoming State Forestry Division
	Wyoming Highway Patrol
	Wyoming Office of Homeland Security
	Fremont County - Public Health and EMA
	Hot Springs County EMA

Jurisdictions and Stakeholders	Representatives
	Wind River Transportation Authority
Private Industry/Stakeholders	EST Construction/Equipment

WSP and each Emergency Management Coordinator identified key county, municipal, tribal, and other local government and stakeholder representatives. Letters of invitation were emailed to invite them to participate as members of the Regional HMPC and to attend a series of planning workshops. During the plan development process communication amongst the county and tribal planning teams occurred through a combination of face-to-face meetings, conference calls, a web-based meeting, phone interviews, and mail and email correspondence.

During the kickoff meeting WSP presented information on the scope and purpose of the plan update, participation requirements of HMPC members, and the proposed project work plan and schedule. A plan for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. The HMPC reviewed the hazard identification information for each county and the Region and refined the list of identified hazards to mirror that of the Wyoming Hazard Mitigation Plan. In follow-up to the meeting, participants were provided a GIS needs worksheet to facilitate the collection of information needed to support the plan update, and a summary of the conference call.

Following the initial kickoff using Teams on February 17, 2022, three virtual planning workshops were held during the plan's development between February and August 2022. The meeting schedule and topics are listed below. In addition, monthly conference calls were held with the Emergency Management Coordinators, Wyoming OHS and WSP to discuss the process including upcoming milestones and information needs. The sign-in sheets, meeting summaries, and agendas for each of the meetings are documented in Appendix A. Additionally a monthly coordination call was held with the county emergency management coordinators, WOHS, and WSP to discuss planning

HMPC planning workshops were scheduled as follows.

- Workshop #1: Kickoff meeting
 - February 17, 2022
- Workshop #2: Hazard Identification and Risk Assessment and Goals update
 - May 19, 2022 – Sublette County and Northern Arapaho and Eastern Shoshone Tribes
 - June 9, 2022 – Fremont County
 - The purpose of this workshop was to review the results of the risk assessment and review and update/develop goals.
- Workshop #3: Mitigation Strategy update
 - August 18, 2022 – Fremont and Sublette Counties
 - February 13, 2023 – Northern Arapaho and Eastern Shoshone Tribes
 - This workshop focused on the update of the mitigation strategy and brainstorming new mitigation actions to include in the HMP.

In some cases, HMPC meetings were supplemented with additional meetings, emails, and telephone discussions to further engage the municipalities in the process. During May-December 2022, Fremont County OEM engaged with Riverton, Shoshoni, and Pavillion elected officials in additional discussions on the planning effort, but ultimately these entities declined to fully participate and will not be adopting this version of the plan. In addition, WOHS presented on mitigation information in the state in the City of Riverton on August 5, 2022, as part of the state's "Mitigation Roadshow". Representatives from Fremont

County, Dubois, Hudson, and Lander attended this meeting. Big Piney in Sublette County was provided the opportunity but declined to fully participate in the 2022 update. The Hoback Ranches Special Services District in Sublette County was a new participant during the 2022 update.

Planning Step 2: Involve the Public

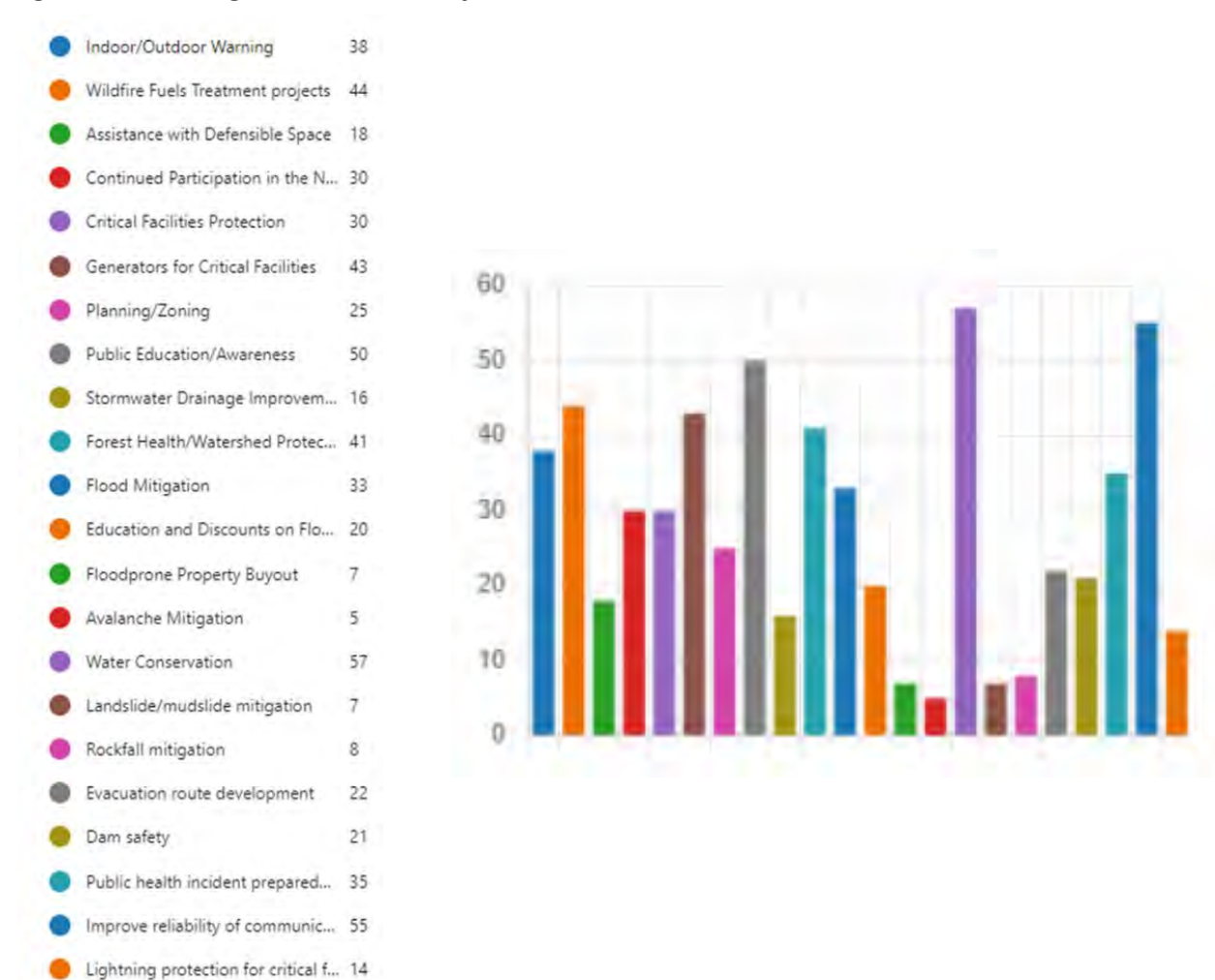
The 2022 planning process was an open one, with the public informed and involved early in the process. In some cases, the HMPC meetings included members of the public and/or local media. Public outreach included social media (Facebook) notices, a public survey, and a public comment form to allow the public the opportunity to share comments on the draft plan.

2022 Public Survey

During the regional planning process and drafting stage, a public survey was developed as a tool to gather public input. The survey was for the public to provide feedback to the county and tribal planning teams on topics related to hazard concerns and reducing hazard impacts. The survey provided an opportunity for public input during the planning process, prior to finalization of the plan update. The survey gathered public feedback on concerns about wildfires, floods, winter storms and other hazards and solicited input on strategies to reduce their impacts. The highest rated hazards in Region 5 were winter storms, wind, and flood. The survey was released as both an online tool on or around March 2022 and closed in May 2022. The counties and tribes provided links to the public survey by distributing it using social media, email, and posting the link on websites. In total, 98 were received and shared with the county and tribal planning committees to inform the process.

The public survey included a question on ranking hazard significance. The results generally track with the significance levels noted in Chapter 4 of this plan, with drought, wind, winter storm, wildfire, and extreme cold as being the most significant. The following graph is a display of the results from Question 5. Question 5 read: "The following types of mitigation actions may be considered in Wyoming Region 5. Please indicate all the types of mitigation actions that you think should have the highest priority in the Wyoming Region 5 Hazard Mitigation Plan. These results will be considered during the planning process." The results indicate that water conservation, improving reliability of communication systems, public education/awareness, wildfire fuels treatment projects and generators for critical facilities were popular with the public (Figure 3-2). Additional results of the survey are included in Appendix A Planning Process Documentation.

Figure 3-2 Region 5 Public Survey Results, Question



Prior to finalizing, a draft of the regional plan was made available to the public for review and comment during January 25-February 8th, 2023. The plan was placed on the Wyoming OHS's web page and the counties used social media and email blasts to announce the public comment period. An on-line feedback form was provided to collect specific comments. No comments from the public were received through the form, but some email comments were provided by Sublette County Emergency Management and the Town of Pinedale, which resulted in minor clarifications and changes in a few sections of the plan to improve accuracy of information.

This accomplished task three (3) in the FEMA Local Mitigation Planning Handbook (Create an outreach strategy).

Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Neighboring communities, tribal and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as other interests, businesses, academia and other private and non-profit interests were also invited to provide feedback. Based on their involvement in hazard mitigation activities or their role in land stewardship in the Region,

representatives from several state and federal agencies and local businesses were included in the HMPC in 2022 and are noted in Table 3-3. Many of these stakeholders participated in planning meetings or were provided an opportunity to review the draft plan before it was finalized.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is an important aspect of mitigation planning. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. Each county, the tribes, and most municipalities in the Region use a variety of comprehensive planning mechanisms, such as master plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions. Examples of this include.

- County comprehensive plans
- Community Wildfire Protection Plans
 - Sublette County CWPP (2022)
 - Fremont County CWPP (2019)
- Wind River Reservation 20-Year Land Use Development Plan (2004)
- Wyoming Hazard Mitigation Plan (2020)

Other documents were reviewed and cited, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment.

3.4.2 Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

WSP led the HMPCs in an effort to identify and document all the hazards that have, or could, impact the planning area. The 2017 Region 5 Hazard Mitigation Plan, and Wyoming State Hazard Mitigation Plan provided a basis for many of the hazard profiles. Where data permitted, Geographic Information Systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. Sophisticated analyses for flood, landslide and wildfire hazards were performed by WSP that included an analysis of flood risk based on the Digital Flood Insurance Rate Maps (DFIRMs), where available. A more detailed description of the risk assessment process and the results are included in Chapter 4 Hazard Analysis and Risk Assessment.

Also included in the 2022 plan update is a capability assessment to review and document the planning area's current capabilities to mitigate risk and vulnerability from hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. The results of the updated capability assessment are captured in each annex.

3.4.3 Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

WSP facilitated discussion sessions with the HMPC's that described the purpose and the process of developing planning goals, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This process was used to update and enhance the mitigation action plan, which is the essence of the planning process and one of

the most important outcomes of this effort. The action plans are detailed in each county and the reservation annex; the process used to identify and prioritize mitigation actions is described in greater detail in Chapter 5 Mitigation Strategy.

Planning Step 8: Draft an Action Plan

Based on input from the HMPC's regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, WSP produced a complete first draft of the Regional Plan. This complete draft was shared for HMPC review and comment by email from the consultant and also posted on the project cloud-based share drive. HMPC comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. Other agencies and neighboring county emergency managers were invited to comment on this draft as well. WSP integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Wyoming Office of Homeland Security and FEMA Region VIII to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

3.4.4 Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction. As the adoption process follows the FEMA plan review and approval, copies of the adoption resolution will be included electronically in Appendix B Records of Adoption.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. Progress on the implementation of specific actions identified in the plan is captured in a discussion and the mitigation action plan summary table in Chapter 5 Mitigation Strategy. An overall implementation strategy is described in Chapter 6 Plan Adoption, Implementation and Maintenance.

Finally, there are numerous organizations within the Region 5 planning area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is important to the ongoing success of this plan, and mitigation in Region 5, and is addressed further in Chapter 6. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Chapter 6 and specifics are also in the annexes for the two counties and the reservation.

4 Hazard Analysis and Risk Assessment

44 CFR Requirement 201.6(c)(2): [The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce the losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

44 CFR Requirement 201.7(c)(2): [The plan shall include] a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Tribal risk assessments must provide sufficient information to enable the Indian tribal government to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment builds upon the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which recommends a four-step process for conducting a risk assessment:

1. Describe Hazards
2. Identify Community Assets
3. Analyze Risks
4. Summarize Vulnerability

Data collected through this process has been incorporated into the following sections of this chapter:

Section 4.1 Hazard Identification identifies the hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.

Section 4.2 Hazard Profiles discusses the threat to the planning area and describes previous occurrences of hazard events, the likelihood of future occurrences, and the Region's vulnerability to hazard events.

County and Reservation Annexes include summaries of community assets including population, building stock, critical facilities, and historic, cultural, and natural resources. Additional details on vulnerability to specific hazards where they vary from those of the Region are noted in the annexes, with more details including maps, where appropriate.

4.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type of all natural hazards that can affect the jurisdiction.

Requirement §201.7(c)(2)(i): [The risk assessment shall include a] description of the type, location, and extent of all natural hazards that can affect the tribal planning area.

The Hazard Mitigation Planning Committee (HMPC) from each county and tribes in the Region conducted a hazard identification study to determine the hazards that threaten the planning area.

4.1.1 Results and Methodology

Using existing hazards data, plans from participating jurisdictions, and input gained through planning and public meetings, the HMPCs of Fremont County, Sublette County, and Wind River Reservation agreed upon a list of hazards that could affect the Region. Hazards data from FEMA, the Wyoming Office of Homeland Security (including the 2020 State of Wyoming Multi-Hazard Mitigation Plan), the National Oceanic and Atmospheric Administration (NOAA), the Spatial Hazard Events and Losses Database for the United States (SHELDUS), and many other sources were examined to assess the significance of these hazards to the planning area. The hazards evaluated in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

The final list of hazards identified and investigated for the 2022 Region 5 Multi-Hazard Mitigation Plan includes:

- Avalanche
- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Cold
- Flood
- Hail
- Hazardous Materials
- High Winds and Downbursts
- Landslide/Rockfall/Debris Flow
- Lightning
- Mine Subsidence
- Severe Winter Weather
- Tornado
- Wildfire

Members of each HMPC used a hazards worksheet to rate the significance of hazards that could potentially affect the region. Significance was measured in general terms, focusing on key criteria such as the likelihood of the event, past occurrences, spatial extent, and damage and casualty potential. Table 4-1 represents the worksheet used to identify and rate the hazards and is a composite that includes input from all the participating jurisdictions. Note that the significance of the hazard may vary from jurisdiction to jurisdiction. The county annexes include further details on hazard significance by county and municipality while the Wind River Reservation Annex has details specific to the Northern Arapaho and Eastern Shoshone tribes. Changes in the hazard identification list in 2022 are noted with an asterisk in the table below. A single asterisk (*) notes a decrease in rating and two asterisks (**) indicate an increase based on the HIRA update process in 2022.

Table 4-1 Region 5 Hazard Significance Summary Table

Hazard	Fremont	Sublette	Wind River Reservation
Avalanche	L	M*	L
Dam Failure	M**	M**	H**

Hazard	Fremont	Sublette	Wind River Reservation
Drought	H	H	H
Earthquake	M	M	M
Expansive Soils	L	L	L
Extreme Cold	L	L*	L
Flood	H	M	H
Hail	M*	M*	M*
Landslide	M	M	M
Lightning	H	H	H
Mine Subsidence	L	L	L
Tornado	L	L	L
Wildfire	H	H	H
Wind	M*	M	M*
Winter Storm	H	H	H
Hazardous Materials	L*	L*	L*

Geographic Extent

Negligible: Less than 10 percent of planning area or isolated single-point occurrences

Limited: 10 to 25 percent of the planning area or limited single-point occurrences

Significant: 25 to 75 percent of planning area or frequent single-point occurrences

Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity

Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.

Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.

Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths.

Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical

Probability of Future Occurrences

Unlikely: Less than 1 percent probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.

Occasional: Between a 1 and 10 percent probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.

Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years

Highly Likely: Between 90 and 100 percent probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance

Low (L): Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.

Medium (M): The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.

High (H): The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

Hazard	Fremont	Sublette	Wind River Reservation
response system is overwhelmed for an extended period of time or many deaths occur.			

Hazards considered but not profiled further include volcanism and contagious disease. The region is potentially vulnerable to an eruption of the Yellowstone Caldera due to the relative proximity to Yellowstone National Park. A large-scale eruption would have catastrophic global impacts. Because of the overly long expected occurrence of frequency (greater than 10,000 years) for explosive volcanism at Yellowstone, and the fact that a good response or mitigation plan is not possible for an event of this magnitude, it was not analyzed in this document. It is also likely that there would be precursory seismic and thermal events of smaller magnitude that would provide some advanced warning. Windblown deposits include sands that can be mobilized by wind during extended drought. This was not considered to be a significant hazard in the region and thus not profiled further. Contagious disease had some recent impacts with the 2020-2023 COVID-19 pandemic, particularly with the Wind River Reservation, but the HMPC felt this hazard was better addressed in other planning mechanisms.

Disaster Declaration History

As part of the hazard identification process, the HMPC researched past events that triggered federal and/or state emergency or disaster declarations in the planning area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

A USDA declaration will result in the implementation of the Emergency Loan Program through the Farm Services Agency. This program enables eligible farmers and ranchers in the affected county as well as contiguous counties to apply for low interest loans. A USDA declaration will automatically follow a major disaster declaration for counties designated major disaster areas and those that are contiguous to declared counties, including those that are across state lines. As part of an agreement with the USDA, the SBA offers low interest loans for eligible businesses that suffer economic losses in declared and contiguous counties that have been declared by the USDA. These loans are referred to as Economic Injury Disaster Loans.

Table 4-2 provides information on federal emergencies and disasters declared in Wyoming Region 5 jurisdictions between 1963 and 2021.

Table 4-2 Major Disaster Declarations in Wyoming: 1963 – 2021

Event/ Hazard	Year	Declaration Type	Remarks/Description
Heavy rains, flooding	1963	Presidential – Major Disaster Declaration	
Drought	1977	Presidential-- Emergency Declaration	Sublette County included in Designated Areas

Event/ Hazard	Year	Declaration Type	Remarks/Description
Severe storms, flooding, mudslides	1978	Presidential – Major Disaster Declaration	
Severe storms, tornadoes	1979	Presidential – Major Disaster Declaration	
Severe storms, hail, flooding	1985	Presidential – Major Disaster Declaration	
Methane gas seepage	1987	Presidential-- Emergency Declaration	
Severe winter storm	1999	Presidential – Major Disaster Declaration	
Winter storm	2000	Presidential – Major Disaster Declaration	
Hensel Fire	2002	Fire Mgmt Assistance Declaration	
Reese Mountain Fire	2002	Fire Mgmt Assistance Declaration	
Commissary Ridge Fire	2002	Fire Mgmt Assistance Declaration	
Tongue River Fire	2003	Fire Mgmt Assistance Declaration	
Tornado	2005	Presidential – Major Disaster Declaration	
Drought	2006	USDA Declaration	Statewide drought affecting Region 5
Thorn Divide Fire Complex	2006	Fire Mgmt Assistance Declaration	
Jackson Canyon Fire	2006	Fire Mgmt Assistance Declaration	
Drought	2007	USDA Declaration	Statewide drought affecting Region 5
Little Goose Fire	2007	Fire Mgmt Assistance Declaration	
Drought	2009	USDA Declaration	
Severe freeze	2009	USDA Declaration	Severe freezes affecting Big Horn, Park, Fremont , Hot Springs, Johnson, Sheridan, Teton, and Washakie Counties
Flooding	2010	Presidential – Major Disaster Declaration	Fremont County included in Designated Areas
Severe Storms, Flooding, and Landslides	2011	Presidential-Major Disaster Declaration	Fremont County included in Designated Areas
Arapahoe Fire	2012	Fire Mgmt Assistance Declaration	
Squirrel Creek Fire	2012	Fire Mgmt Assistance Declaration	
Oil Creek Fire	2012	Fire Mgmt Assistance Declaration	
Sheep Herder Hill Fire	2012	Fire Mgmt Assistance Declaration	
Severe Storms and Flooding	2015	Presidential-Major Disaster Declaration	
Station Fire	2015	Fire Mgmt Assistance Declaration	

Event/ Hazard	Year	Declaration Type	Remarks/Description
Lava Mountain Fire	2016	Fire Mgmt Assistance Declaration	
Tokawana Fire	2016	Fire Mgmt Assistance Declaration	
Heavy Rains, Flooding	2017	Presidential – Major Disaster Declaration	Flooding affecting Fremont, Park and Washakie Counties and the Wind River Reservation
Drought	2018	USDA	Fremont
Drought – FAST TRACK	2018	USDA	Fremont, Sublette
Roosevelt Fire	2018	Disaster Declaration	Fire impacted Sublette County
Freeze	2019	USDA	Fremont
Drought- FAST TRACK	2020	USDA	Seven disaster declarations for drought in 2020. Four in Fremont County, Three in Sublette
Covid-19 Pandemic	2020	Emergency Declaration	Statewide
Covid-19 Pandemic	2020	Presidential – Major Disaster Declaration	Statewide

Source: FEMA, <https://www.fema.gov/disasters>

4.2 Hazard Profiles

Requirement §201.1)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.7(c)(2)(i): [The risk assessment shall include a] description of the type, location, and extent of all natural hazards that can affect the tribal planning area. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Section 4.1, Identifying Hazards are profiled individually in this section. Much of the profile information came from the same sources used to initially identify the hazards.

4.2.1 Profile Methodology

Each hazard is profiled in a similar format that is described below:

Hazard/Problem Description

This subsection gives a description of the hazard and associated problems, followed by details on the hazard specific to the Region.

Geographical Area Affected

This subsection discusses which areas of the Region are most likely to be affected by a hazard event.

Limited: Less than 10 percent of the planning area

Significant: 10 to 50 percent of the planning area

Extensive: 50 to 100 percent of the planning area

Past Occurrences

This subsection contains information on historic incidents, including impacts where known. Information provided by the Regional Steering Committee is included here along with information from other data sources, including NOAA's National Centers for Environmental Information (NCEI) Storm Events Database. When available, tables showing county-specific data from the NCEI database may be found in each hazard profile.

Frequency/Likelihood of Occurrence

The frequency of past events is used in this section to gauge the likelihood of future occurrences. Based on historical data, the likelihood of future occurrences is categorized into one of the following classifications:

- **Highly Likely**—Near 100 percent chance of occurrence in next year, or happens every year.
- **Likely**—Between 10 and 100 percent chance of occurrence in next year, or has a recurrence interval of 10 years or less.
- **Occasional**—Between 1 and 10 percent chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
- **Unlikely**—Less than 1 percent chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

The frequency, or chance of occurrence, was calculated where possible based on existing data. Frequency was determined by dividing the number of events observed by the number of years and multiplying by 100. Stated mathematically, the methodology for calculating the probability of future occurrences is:

$$\frac{\text{\# of known events}}{\text{years of historic record}} \times 100$$

This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period which equates to 10 percent chance of that hazard occurring any given year.

Changing Future Conditions

This subsection to the Frequency/Likelihood of Occurrence section discusses the potential impacts of future changing conditions in the climate and how those changes may increase or decrease natural hazards frequency and intensity.

Potential Magnitude

This subsection discusses the potential magnitude of impacts, or extent, from a hazard event. Magnitude classifications are as follows:

- **Catastrophic**—More than 50 percent of property severely damaged, and/or facilities are inoperable or closed for more than 30 days. More than 50 percent agricultural losses. Multiple fatalities and injuries. Critical indirect impacts.
- **Critical**—25 to 50 percent of property severely damaged, and/or facilities are inoperable or closed for at least 2 weeks. 10-50 percent agricultural losses. Injuries and/or illnesses result in permanent disability and some fatalities. Moderate indirect impacts.
- **Limited**—10 to 25 percent of area affected. Some injuries, complete shutdown of critical facilities for more than one week, more than 10 percent of property is severely damaged.
- **Negligible**—Less than 10 percent of area affected. Minor injuries, minimal quality-of-life impact, shutdown of critical facilities and services for 24 hours or less, less than 10 percent of property is severely damaged.

Vulnerability Assessment

Vulnerability is the measurement of exposed structures, critical facilities, or populations relative to the risk of the hazard. For most hazards, vulnerability is a best estimate. Some hazards, such as flood, affect specific areas so that exposure can be quantified, and vulnerability assessments result in a more specific approximation. Other hazards, such as tornados, are random and unpredictable in location and duration that only approximate methods can be applied. The assessment was conducted through the study of potential impacts to the following specific sectors:

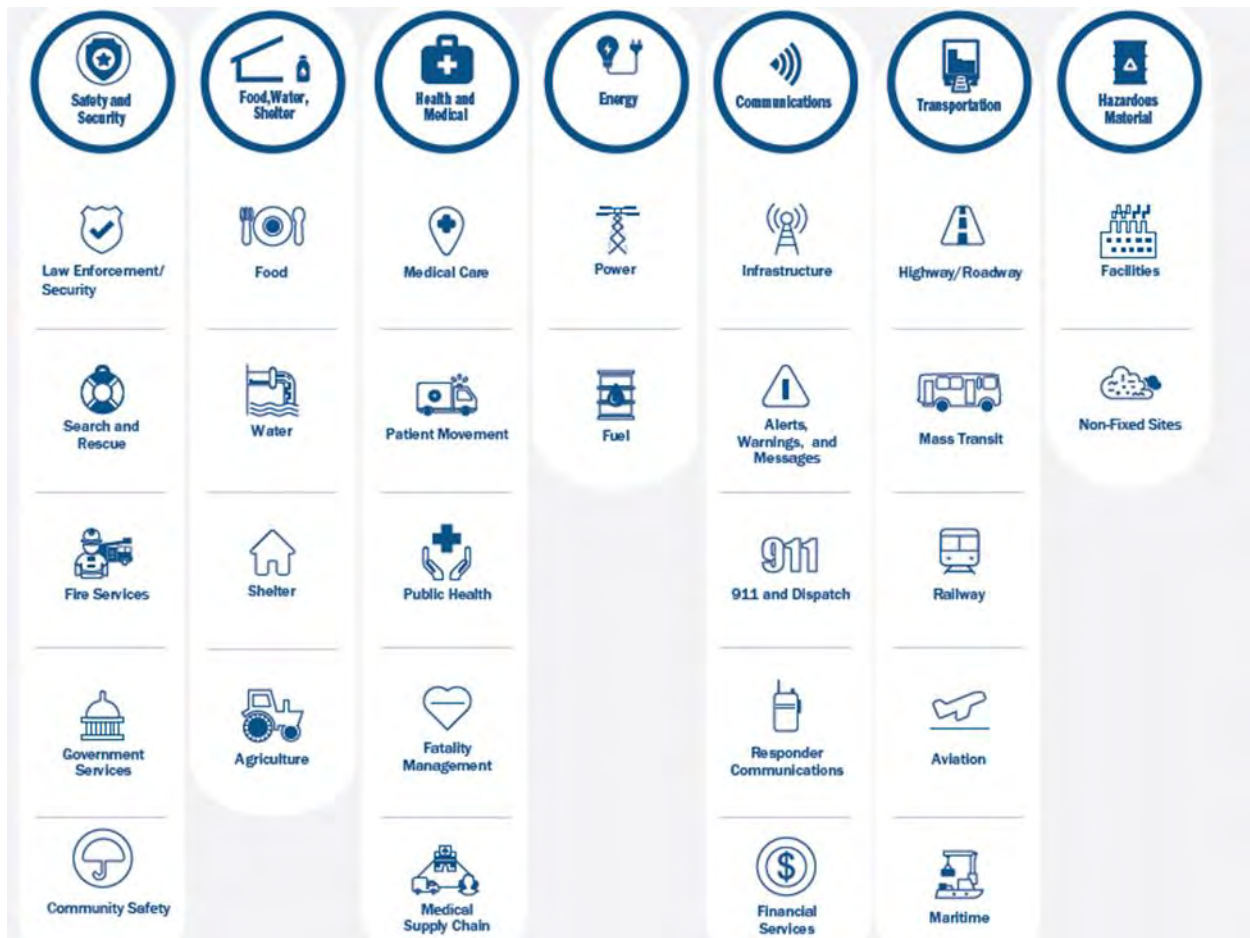
- People
- Property
- Critical Facilities and Infrastructure
- Economy
- Historic, Cultural, and Natural Resources

Assets Summary

Assets inventoried for the purpose of determining vulnerability include people, structures, critical facilities, and natural, historic, or cultural resources. For the regional planning process two standard databases were utilized for the basis of building and critical facility data. The 2021 Parcel and Assessor Data was obtained through the Wyoming Came website which is maintained by the Wyoming Department of Revenue. This information provided the basis for building exposure and property types. The available data is annually updated on the site and contains all counties within Wyoming. Data current as of 2021 was downloaded for all the counties within the Region and joined by Parcel Number in a separate database for analysis using GIS. A critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. Much of this data is based on GIS databases associated with the 2021 Homeland Infrastructure Foundation-Level Data (HIFLD) datasets and the critical State Assets from the 2021-2026 Wyoming State Hazard Mitigation Plan. Where applicable, this information was used in an overlay analysis for hazards such as flood and landslide. More detail on assets potentially exposed to hazards can be found in the county annexes.

FEMA organizes critical facilities into seven lifeline categories as shown in Figure 4-1.

Figure 4-1 FEMA Lifeline Categories



These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators).
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

A summary of the critical facilities exposure analysis can be found in Table 4-3 and Figure 4-2 illustrates the location of critical facilities in Region 5. Table 4-4 and Table 4-5 provide a critical facilities exposure analysis by jurisdictions within each county.

Table 4-3 Region 5 Summary of Critical Facility Exposure Summarized by Lifelines

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Fremont County	593	77	5	8	12	103	180	978
Sublette County	441	8	1	6	1	27	103	587
Total	1,034	85	6	14	13	130	283	1,565

Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 4-4 Fremont County Jurisdictions Summary of Critical Facility Exposure Summarized by Lifelines

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Dubois	2	1	-	-	1	7	7	18
Hudson	-	1	-	-	-	1	1	3
Lander	23	1	-	-	4	24	5	57
Pavillion	5	-	-	-	-	5	-	10
Riverton	85	3	4	-	6	29	8	135
Shoshoni	2	-	-	-	-	5	-	7
Unincorporated	476	71	1	8	1	32	159	748
Total	593	77	5	8	12	103	180	978

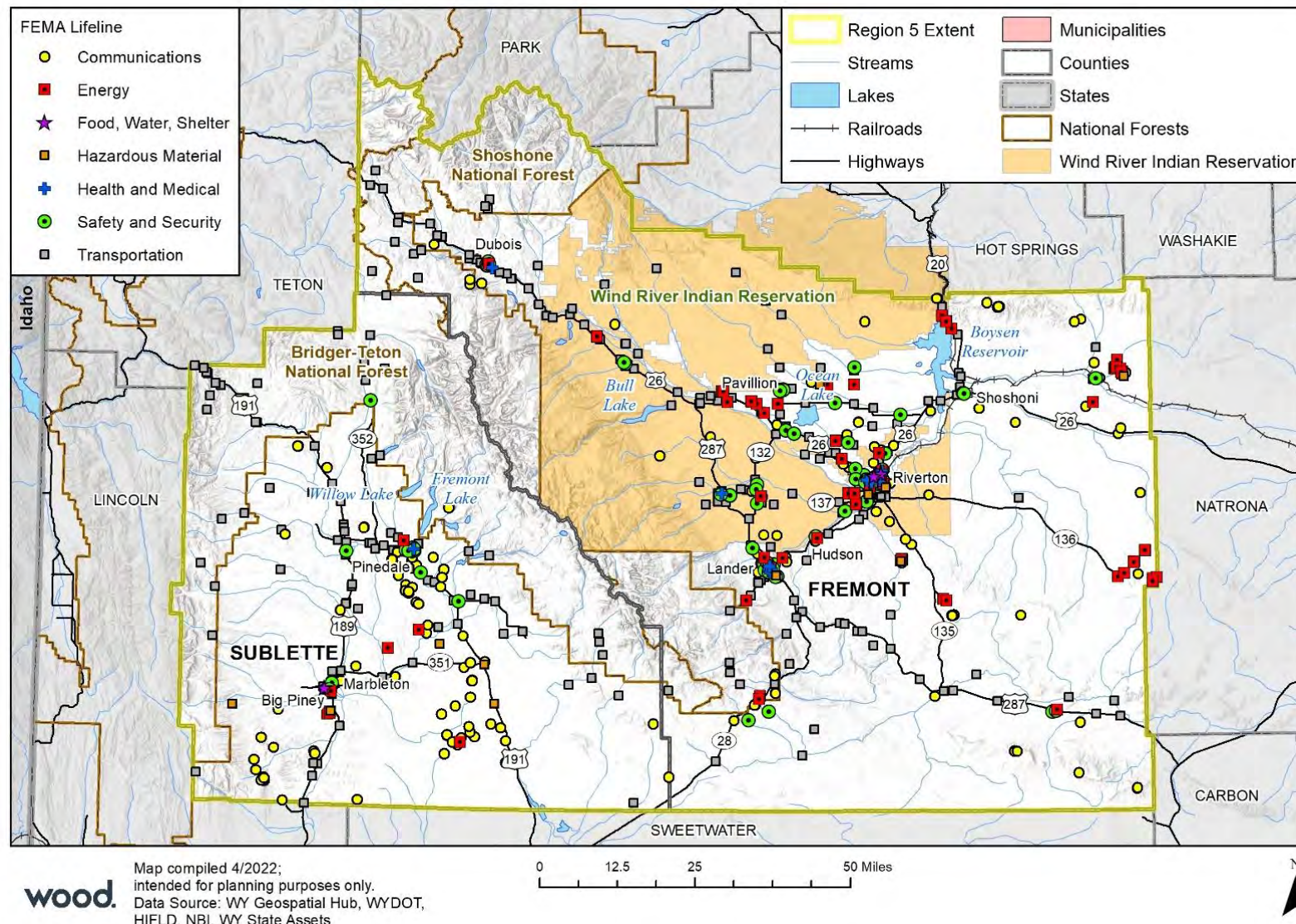
Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 4-5 Sublette County Jurisdictions Summary of Critical Facility Exposure Summarized by Lifelines

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Big Piney	7	1	1	-	-	4	1	14
Marbleton	23	-	-	-	-	1	1	25
Pinedale	30	-	-	-	1	16	4	51
Unincorporated	381	7	-	6	-	6	97	497
Total	441	8	1	6	1	27	103	587

Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Figure 4-2 Region 5 Critical Facilities



Development Trends

This section describes how the hazard could impact future development. Specific trends can be found in each County annex.

Summary

This section summarizes risk by county/reservation according to the area affected, likelihood, and magnitude of impacts. If the hazard has impacts on specific towns or cities in the region they are noted here, where applicable.

4.2.2 Avalanche

Hazard/Problem Description

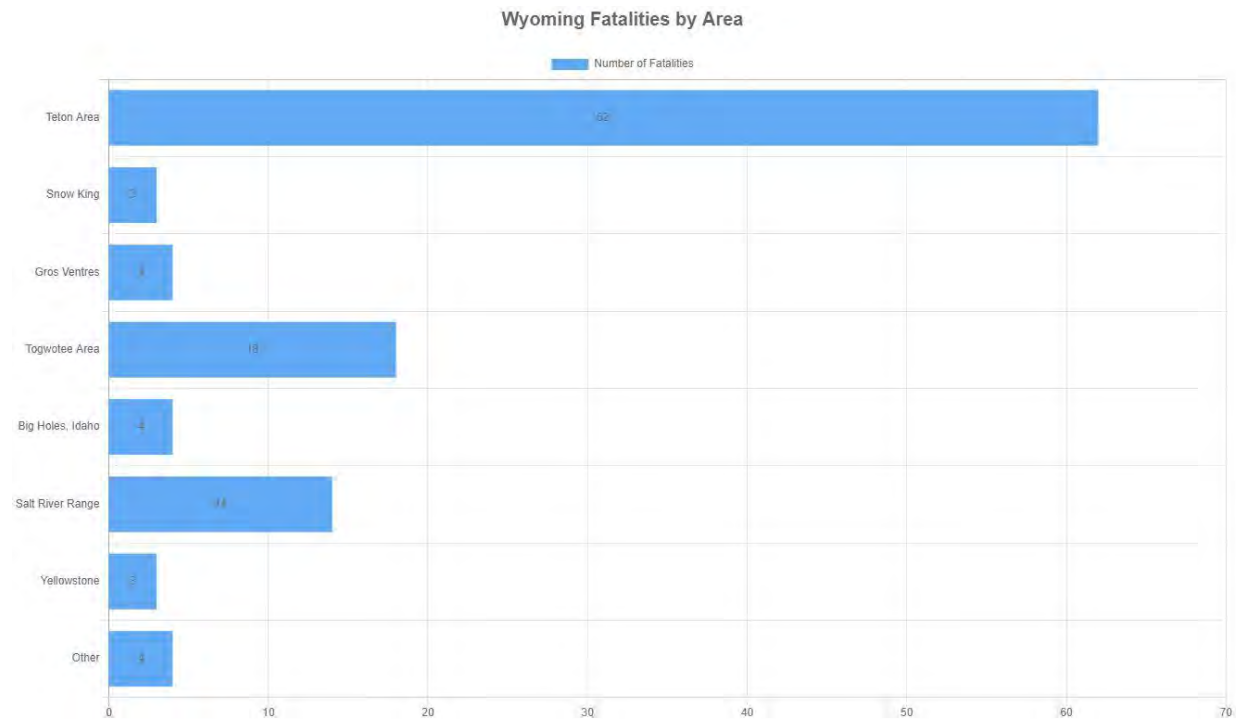
An avalanche is a mass of snow sliding down a mountainside. The vast majority of avalanches occur during and shortly after storms. Avalanches occur when loading of new snow on a slope increases stress at a rate faster than strength develops, and the slope fails. There are four factors that contribute to an avalanche: a steep slope, a snow cover, a weak layer in the snow cover, and a trigger. About 90 percent of all avalanches start on slopes of 30-45 degrees; about 98 percent of all avalanches occur on slopes of 25-50 degrees. Avalanches release most often on slopes above timberline that face away from prevailing winds (leeward slopes collect snow blowing from the windward sides of ridges). Nevertheless, avalanches can run on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees. Very dense trees can anchor the snow to steep slopes and prevent avalanches from starting; however, avalanches can release and travel through a moderately dense forest.

This hazard generally affects a small number of people, such as snowboarders, skiers, and hikers, who venture into backcountry areas during or after winter storms. Road and highway closures, damaged structures, and destruction of forests are also a direct result of avalanches. Areas prone to avalanche hazards include hard to access areas deep in the backcountry.

Geographical Area Affected

Avalanches affect a limited spatial area in the Region. Most avalanches occur in the western part of the state along the Teton Range. Figure 4-3 illustrates the geographic distribution of avalanche fatalities around Wyoming; the majority of the areas are outside of Region 5 with the exception of the Gros Ventre Range which extends into northern Sublette County.

Figure 4-3 Wyoming Avalanche Fatalities by Area: 1913-2022



Source: www.jhavalanche.org

Past Occurrences

Historically, avalanches occur within the Region between the months of December and April, following snowstorms.

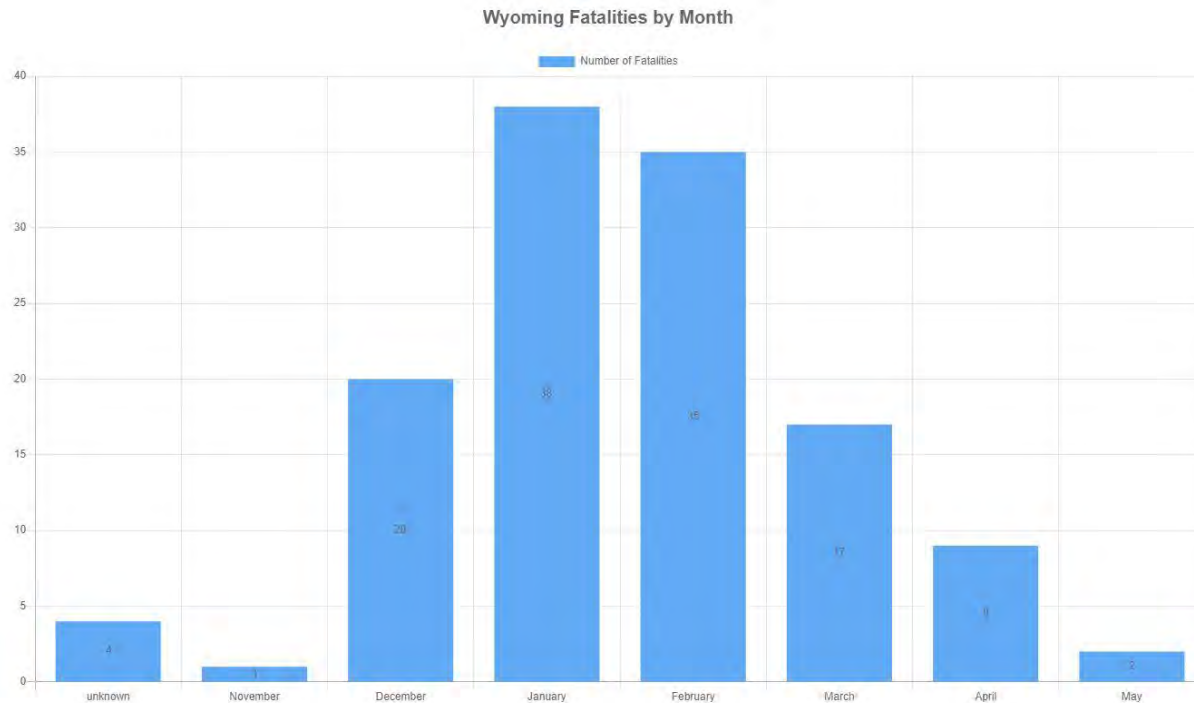
The National Centers for Environmental Information (NCEI) database lists historical avalanche events by zone rather than county. While the database may list multiple events in Fremont and Sublette Counties, these events largely take place in Teton County. The NCEI data is most likely not representative of the history of avalanches in the counties. The Bridger Teton Avalanche Center did not list any avalanche events occurring in Fremont or Sublette Counties, but the county plans provide data specific to the region. The Sublette County HMPC noted closures of Hwy 191 to Jackson periodically for mitigation and backcountry user impacts. A fatality in Cliff Creek involving a backcountry skier in 2013 was a recent event that was also noted. Additionally, the Bridger Teton Avalanche Center did note one fatality of a 31-year-old man on 12/22/2018, which occurred in the Horse Creek Drainage Zone on the west side of Sublette County close to Lincoln County.

Frequency/Likelihood of Future Occurrences

Since avalanche data is limited, it is difficult to determine a likelihood for this hazard. It is important to remember that many avalanches go unreported or undocumented when no fatalities or injuries are involved. Given the terrain and weather conditions in the mountainous areas of the Region, avalanches are likely to occur, but the damages and fatalities should continue to be limited. Injuries and loss of life from an avalanche are usually due to people recreating in remote areas at the wrong time. Many residents and visitors to the Region avidly enjoy outdoor recreation, so it is likely that people will continue to be exposed to avalanche hazards in mountainous areas. The figure below lists the distribution of avalanche fatalities by

month based on statewide statistics, with January and February being the most likely time of year for avalanche accidents.

Figure 4-4 Wyoming Avalanche Fatalities by Month: 1913-2022



Source: www.jhavalanche.org

Changing Future Conditions

The frequency and severity of avalanches is likely to be altered in the future due to changing climate conditions, but more studies are needed. In the last decade many experts in western states have pointed out increased avalanche risk associated with changing patterns in snow, precipitation, accumulation, and overall warmer winter patterns. Snow may fall early in the winter and is then followed by a long period without snow. This creates a thin snowpack that becomes structurally weaker as winter goes on. New layers of snow may not bond well to the weak base layer, creating prime conditions for avalanches. Periods of sporadic snowfall in early and mid-spring also contribute to this process of creating structurally weaker snowpack, which can lead to avalanche activity as snow accumulation has already begun to thaw with the warmer season. Extreme snowfalls in short time periods may also contribute to larger avalanches or changes in avalanche cycles.

Potential Magnitude (Extent)

A number of weather and terrain factors determine avalanche severity and danger:

- Weather:
 - Storms—A large percentage of all snow avalanches occur during and shortly after storms.
 - Rate of snowfall—Snow falling at a rate of 1 inch or more per hour rapidly increases avalanche danger.

- Temperature—Storms starting with low temperatures and dry snow, followed by rising temperatures and wetter snow, are more likely to cause avalanches than storms that start warm and then cool with snowfall.
- Wet snow—Rainstorms or spring weather with warm, moist winds and cloudy nights can warm the snow cover, resulting in wet snow avalanches. Wet snow avalanches are more likely on sun-exposed terrain (south-facing slopes) and under exposed rocks or cliffs.
- Terrain:
 - Ground cover—Large rocks, trees, and heavy shrubs help anchor snow.
 - Slope profile—Dangerous slab avalanches are more likely to occur on convex slopes.
 - Slope aspect—Leeward slopes are dangerous because windblown snow adds depth and creates dense slabs. South-facing slopes are more dangerous in the springtime.
 - Slope steepness—Snow avalanches are most common on slopes of 30 to 45 degrees.

The common factors contributing to the avalanche hazard are old snow depth, old snow surface, new snow depth, new snow type, density, snowfall intensity, precipitation intensity, settlement, wind direction and speed, temperature, and subsurface snow crystal structure.

Figure 4-5 Avalanche Danger Scale

North American Public Avalanche Danger Scale		
Avalanche danger is determined by the likelihood, size and distribution of avalanches.		
Danger Level		Travel Advice
5 Extreme		Avoid all avalanche terrain.
4 High		Very dangerous avalanche conditions. Travel in avalanche terrain not recommended.
3 Considerable		Dangerous avalanche conditions. Careful snowpack evaluation, cautious route-finding and conservative decision-making essential.
2 Moderate		Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern.
1 Low		Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.
No Rating		Watch for signs of unstable snow such as recent avalanches, cracking in the snow, and audible collapsing. Avoid traveling on or under similar slopes.
Safe backcountry travel requires training and experience. You control your own risk by choosing where, when and how you travel.		

Source: American Avalanche Association. <https://avalanche.org/avalanche-encyclopedia/danger-scale/>

Overall, avalanche impacts would likely be negligible in all counties in the Region. However, a road closure due to avalanche activity could result in transportation disruptions due to the limited number of roads region wide. Apart from backcountry skiers, snowshoers, snowmobilers and snowboarders, the threat to life and safety is minimal.

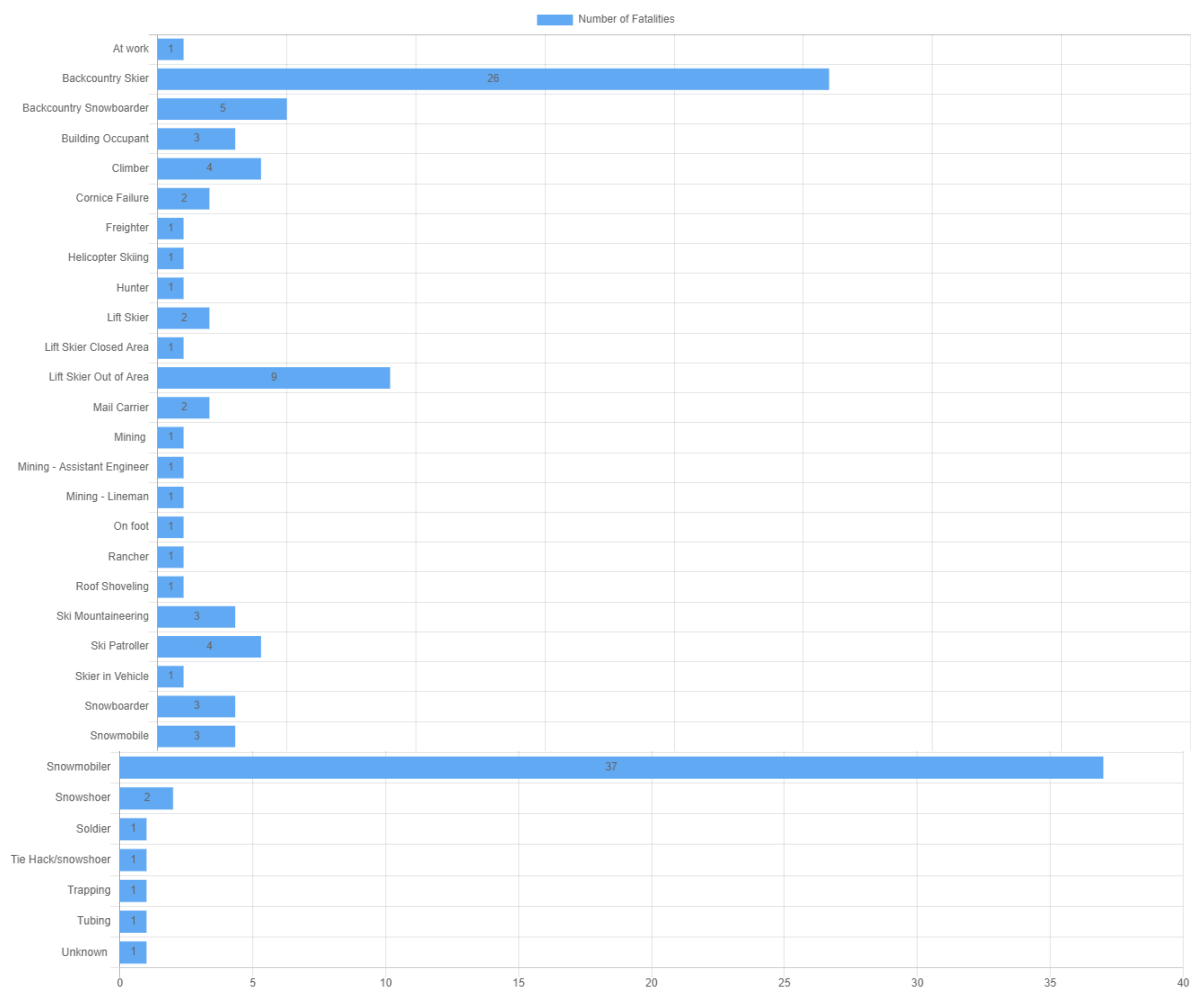
Vulnerability Assessment

Although future avalanches are likely to occur, the spatial extent is limited, and the magnitude is low. Therefore, avalanches are a low significance hazard in the Region. No known critical facilities or cultural resources were located in avalanche paths at the time this plan was written. It is public safety that is most threatened by this hazard. Outdoor recreationalists who travel into backcountry areas are most at risk. Additionally, while road closures help to mitigate impacts to travelers in avalanche-prone areas, snowplow drivers can still be exposed while clearing roads of snow or avalanche debris.

People

Public safety is most threatened by this hazard. Outdoor recreationalists who travel into backcountry areas are most at risk. The following is an analysis of statewide fatalities by activity, based on statistics through 2021, which shows snowmobilers and backcountry skiers involved in the most incidents.

Figure 4-6 Wyoming Avalanche Fatalities by Activity: 1913-2021



Source: www.jhavalanche.org

Backcountry avalanche incidents involve search and rescue teams and resources, which can put these personnel at risk. The key actions to limiting impacts to individuals recreating in hazardous areas include spreading knowledge and awareness of the hazard and being properly equipped for self-rescue, if necessary, with tools such as locator beacons, shovels, GPS units and other communication tools and probes.

While backcountry avalanche incidents are by far the most common, heavy snow can also lead to “roof avalanches” that can sometimes be deadly.

Property

Damages to buildings and property are possible, but exceedingly rare. Given the very limited development and population density in areas of Region 5 which are susceptible to avalanches, it can be assumed that vulnerability to physical property is low. Vehicles could become damaged or destroyed if caught in an avalanche which blocks a road or highway.

Critical Facilities and Lifelines

Avalanches can cause several types of secondary effects, such as blocking roads, which can isolate residents and businesses and delay commercial, public, and private transportation. While road closures help to mitigate impacts to travellers in avalanche-prone areas, snowplow drivers can still be exposed while clearing roads of snow or avalanche debris. Road closures could also impact the ability for emergency response and first responders to respond quickly to an incident. Other potential problems resulting from avalanches are power and communication failures. It is unlikely that there are critical facilities exposed to avalanche hazards, although there may be some facilities in particular the possibility of disruption to the electrical grid network. Other potential problems resulting from avalanches are power and communication failures.

Economy

Avalanche activity inside or outside the Region (along connecting roadways) can disrupt transportation in and out of the local communities, which could result in temporary economic impacts. Closures of transportation routes into or out of the Region could prevent the import and export of goods and services, as well as disrupt tourism.

Environment and Cultural Resources

Avalanches are a natural event, but they can negatively affect the environment. This includes trees located on steep slopes. A large avalanche can knock down many trees and kill the wildlife that live in them. In spring, this loss of vegetation on the mountains may weaken the soil, causing landslides and mudflows. If significant woody debris reaches the valley bottoms this could cause a potential for ponding and flooding. The impact on historic or cultural resources in the Region is unknown.

Development Trends

Avalanche vulnerability could increase with future development and population growth as there will be a higher number of people driving on roadways and taking part in backcountry recreation. It is unlikely that risk to structures will increase as long as future development is planned outside of mapped or suspected avalanche hazard zones.

Risk Summary and Overall Significance by Jurisdiction

Overall, avalanches are a low significance hazard to counties in the Region. Impacts are isolated to backcountry users and possibly first responders. Sublette County can have interrupted delivery of goods and services from Idaho from avalanches on highways through Teton County. Sublette search and rescue can be involved in response to backcountry incidents. No municipalities are directly at risk from avalanches.

Table 4-6 Avalanche Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Limited	Highly Likely	Limited	Low
Sublette	Significant	Highly Likely	Limited	Medium
Wind River Reservation	Limited	Highly Likely	Limited	Low

4.2.3 Dam Failure

Hazard/Problem Description

Dams are man-made structures built for a variety of uses, including flood protection, power, agriculture, water supply, and recreation. Dams typically are constructed of earth, rock, concrete, or mine tailings. Dams and reservoirs serve a very important role for Wyoming residents and industry. Rarely, however, the dams fail, either completely or partially, and become a significant hazard for those downstream.

Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream.

Dam failure occurs when the retention function of the dam is compromised, in part or in its entirety. Damage to a dam structure that may result in a failure may be caused by many sources:

- Prolonged periods of rainfall and flooding, which result in overtopping
- Earthquake
- Inadequate spillway capacity resulting in excess overtopping flows
- Internal erosion caused by embankment or foundation leakage or piping or rodent activity
- Improper design
- Age
- Improper maintenance
- Negligent operation
- Failure of upstream dams on the same waterway
- Vandalism or terrorism

A dam failure is not the only type of emergency associated with dams. Spillway discharges that are large enough to cause flooding in downstream areas or flooding upstream of dams due to backwater effects or high pool levels are both considered dam emergencies and may cause significant property damage and loss of life. (Source: US Army Corps of Engineers *Flood Emergency Plans: Guidelines for Corps Dams*. Hydrologic Engineering Center, (June 1980) p 4.)

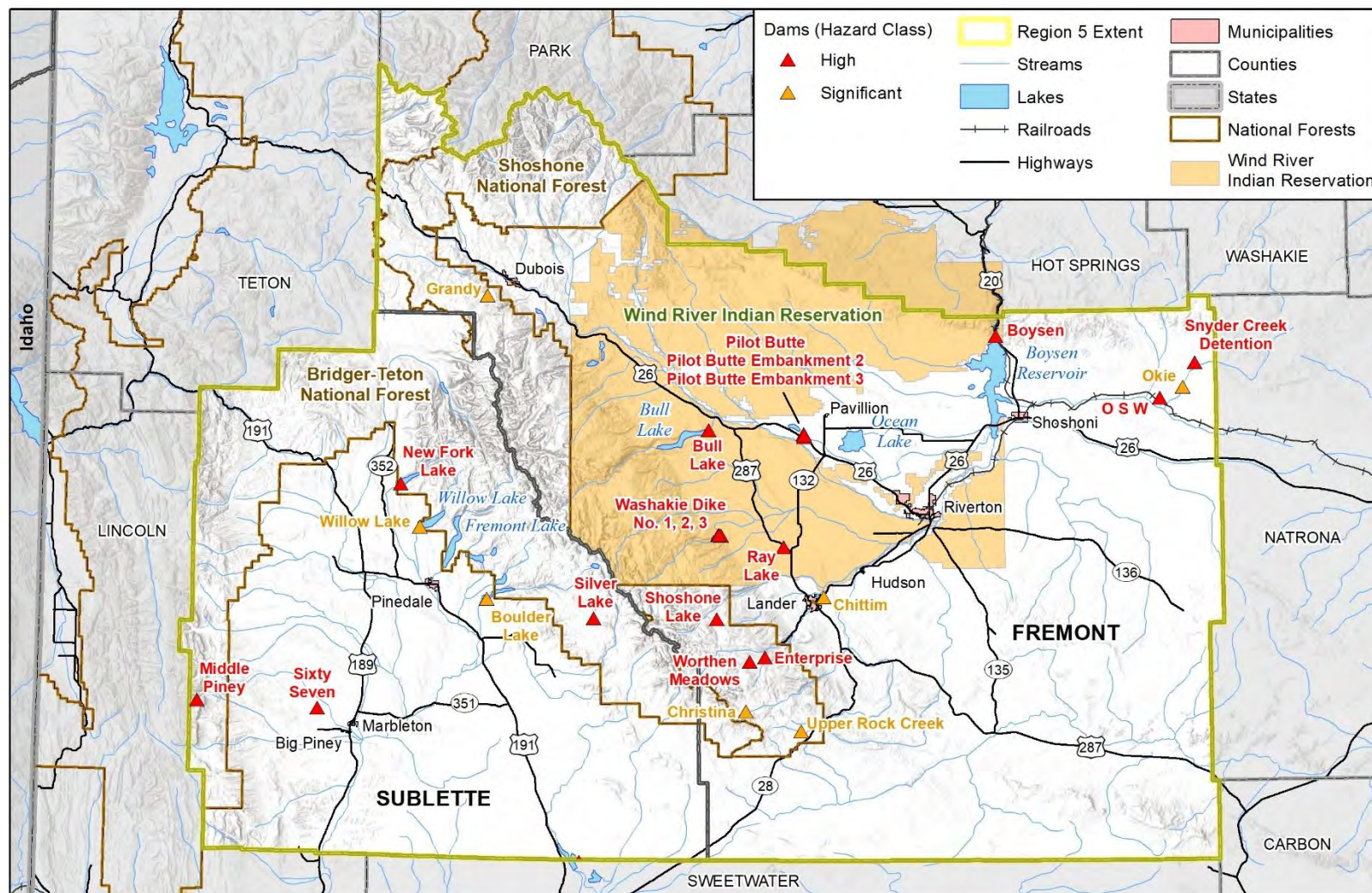
Dam failures can be grouped into four classifications: overtopping, foundation failure, structural failure, and other unforeseen failures. Overtopping failures result from the uncontrolled flow of water over, around, and adjacent to the dam. Earthen dams are most susceptible to this type of failure. Hydraulic failures account for approximately 28% of all dam failures. Foundation and structural failures are usually tied to seepage through the foundation of the main structure of the dam. Deformation of the foundation or settling of the embankment can also result in dam failure. Structural failures account for approximately 28% of all dam failures, and foundation problems account for another 25%. Earthquakes or sabotage account for 12% of all dam failures, while inadequate design and construction account for the remaining 7% of failures.

Dam failures result in a unique source of flash flooding, when a large amount of previously detained water is suddenly released into a previously dry area due to a failure in some way of the dam. Dams are classified into three classes. The State of Wyoming has adopted FEMA's risk classifications as set forth in FEMA's Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams. These guidelines define High Hazard (Class I) dams as those rated based on an expected loss of human life, should the dam fail, and Significant Hazard (Class II) dams as those rated based on expected significant damage, but not loss of human life. Significant damage refers to structural damage where humans live, work, or recreate, or public or private facilities exclusive of unpaved roads and picnic areas. Damage refers to making the structures inhabitable or inoperable. Low hazard dams would have minimal downstream impacts from a failure.

Geographical Area Affected

Figure 4-7 lists the dams specifically located in Region 5. This data is based off of Wyoming's National Inventory of Dams information. According to the National Inventory of Dams database, there are 73 dams in Fremont County, 35 in Sublette County and 9 in the Wind River Reservation for a total of 117 dams being located in Region 5. Twenty are classified as High Hazard (Class I) and 7 are classified as Significant Hazard (Class II). Most of the high hazard dams are located in Fremont County with 15 total. Tables below include details of the High and Significant Hazard Dams sorted by the county where they are located.

Figure 4-7 Locations of High and Significant Hazard Dams Affecting Region 5



wood. Map compiled 1/2023;
intended for planning purposes only.
Data Source: WY Geospatial Hub, WYDOT,
National Inventory of Dams

0 12.5 25 50 Miles



Table 4-7 High and Significant Hazard Dams in Fremont County

Dam Name	City	Hazard Potential Classification
Boysen	BOYSEN	High
Bull Lake	RIVERTON	High
Enlargement of Worthen Meadows	LANDER	High
Enterprise	LANDER	High
O S W	LYSITE	High
Pilot Butte	RIVERTON	High
Pilot Butte Embankment 2	RIVERTON	High
Pilot Butte Embankment 3	RIVERTON	High
Ray Lake	LANDER	High
Shoshone Lake	MILFORD	High
Snyder Creek Det Dam X	LOST CABIN	High
Washakie	FT. WASHAKIE	High
Washakie Dike No. 1	FT WASHAKIE	High
Washakie Dike No. 2	FT WASHAKIE	High
Washakie Dike No. 3	FT WASHAKIE	High
Chittim	HWY. 789	Significant
Christina	LANDER	Significant
Grandy	DUBOIS	Significant
Okie	LOST CABIN	Significant
Upper Rock Creek	ATLANTIC CITY	Significant

Source: National Inventory of Dams, Wyoming, Fremont County

Table 4-8 High and Significant Hazard Dams in Sublette County

Dam Name	City	Hazard Potential Classification
Middle Piney Lake Dam	BIG PINEY, WY	High
New Fork Lake	PINEDALE	High
Silver Lake	NONE	High
Sixty Seven	BIG PINEY	High
Boulder Lake	BOULDER	Significant
Willow Lake	BOULDER	Significant

Source: National Inventory of Dams, Wyoming, Sublette County

The majority of high hazard dams are located in Fremont County with 15 and four being located in Sublette County. Each of the 19 high hazard dams within Region 5 have Emergency Action Plans. The majority of high hazard dams in this region are owned and operated by Reclamation. Communities such as Big Piney, Ft. Washakie, Riverton and Lander are a large portion of the communities that could have severe repercussions if one of these high hazard dams were to fail. Region 5 in Wyoming has several dams that are located in the area of Wind River Indian Reservation. Bull Lake, Pilot Butte, Ray Lake, Washakie & Washakie Dike No. 1, 2, 3, could all have a considerable impact on Riverton and the surrounding areas. As Wind River Indian Reservation is centrally located within the Region 5 boundary.

Downstream Emergency Action Plans (EAPs) for each of the dams listed in the table above include inundation maps and downstream warning and notification plans, including local emergency services agencies and municipal contacts to be used in the event of a breach or imminent threat. Given the geographical extent and number of High and Significant dams in the Region the rating is Significant for the Region.

The County and Reservation HMPCs discussed dam failure and potential areas of concern. The HMPC for the Wind River Reservation noted that landslide dams are a concern, especially in the western portion of the Reservation; the HMPC also noted areas above Bull Lake that are a potential concern.

The Sublette County HMPC noted Fremont Lake as a concern due to its proximity to Pinedale. It is primarily a natural lake, that has had some enhancement for storage and there is no means to regulate flow from the lake during high runoff years.

Past Occurrences

The Region has experienced a few instances of dam failure. A small dam incident occurred in Sublette County in 2013, when an avalanche introduced logs to the Middle Piney Lake. The logs blocked the outlet, causing the water to rise. This was mitigated before major damage occurred, however.

The Teton Dam collapsed on June 5th, 1976, and caused eleven deaths, up to 2 billion dollars in damage and 16,000 livestock being lost. The Teton Dam was located along the Snake River Plain and its collapse occurred as a result of permeable loss soil being used in the core and on fissured rhyolite in the abutments of the dam that allowed water to penetrate around and through the earth-fill dam. Dam incidents can also occur which do not involve the total failure of the dam. According to the Dam Incident Database from the National Inventory of Dams, which was most recently updated August 19, 2020, there have been no dam incidents involving dams in Region 5 recently.

Frequency/Likelihood of Future Occurrences

It is estimated from analysis that Region 5 can expect to be occasionally affected by dam failure in the future. The structural integrity of dams depends on regular inspections and maintenance. Sublette County has four dams and Fremont 15 that are considered to be high hazard. All four of the high hazard dams in Sublette are assessed to be in poor condition. While the condition assessment information for Fremont is not available for six of the high hazard dams, the Snyder Creek Detention Dam, is assessed to be unsatisfactory and three are not rated. Only one, Enterprise Dam is considered to be in fair condition.

Additionally, a number of the dam failures in Wyoming and other Rocky Mountain states occurred because of snow melt flooding that exceeded the capacity and strength of levees and dams. Wyoming's dams will continue to be tested by snow melt, heavy rains, and other types of floods every year. Thus, dam failures could possibly threaten Wyoming and Region 5 counties,

Changing Future Conditions

With changes in the occurrence of extreme precipitation events, dam failure and dam incidents could become a greater concern if increased rainfall events result in large floods that stress dam infrastructure. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hydrograph changes, it is conceivable that the dam can lose some or all its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream.

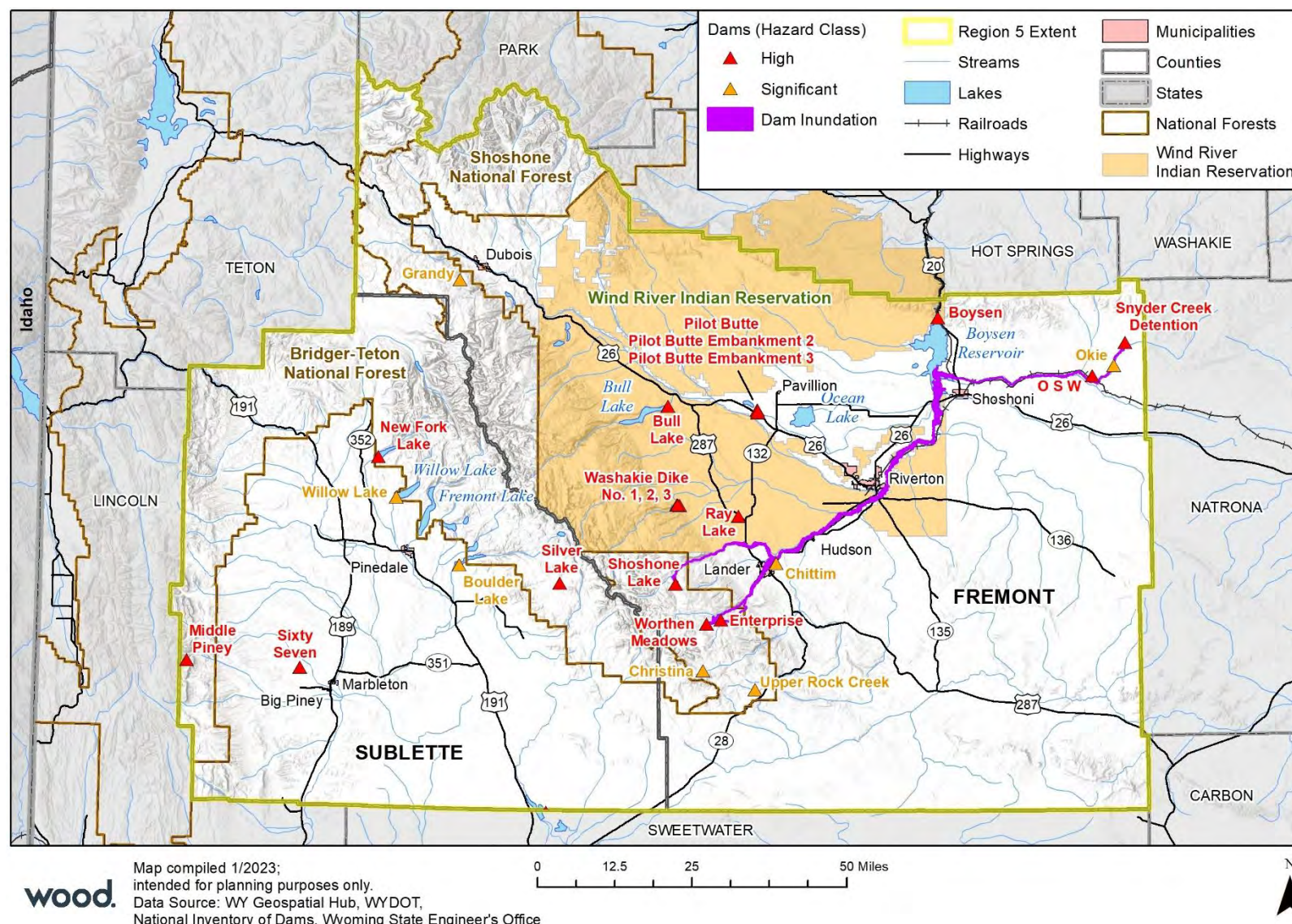
Potential Magnitude (Extent)

Potential impacts could include injury and loss of life, property damage, damage to infrastructure, drinking water contamination, loss of crops and livestock, evacuations and sheltering and associated costs,

interruption of commerce and transportation, search and rescue, and clean-up costs. In addition, dam failure and associated flooding can cause damage to and loss of irrigation structures such as headgates and ditches. Loss or damage to water structures negatively impacts agricultural producers of crops and livestock—and can be costly to repair. Areas of possible inundation from dam failures in Region 5 are shown below in Figure 4-8.

The severity and magnitude of a given dam failure will vary on a county basis and case-by-case basis. This information is considered sensitive and is not detailed due to Homeland Security concerns. Emergency management coordinators have access to inundation maps contained in the emergency action plans for the High Hazard dams in the State. High Hazard (Class I) dams, by definition, would merit a magnitude/severity rating of catastrophic, whereas Significant Hazard (Class II) dams rate as critical and Low Hazard dams fall into the limited rating. The magnitude/severity rating for the hazard in Region 5 is considered mostly critical, mostly due to the number of Class I dams that could impact communities in the Region.

Figure 4-8 Wyoming Region 5 Dam Inundation Risk from Privately Owned High Hazard Dams



Vulnerability Assessment

The failure of Snyder Creek Detention or Boysen Dam could result in hundreds of millions of dollars of damage in downstream communities, although the probability of such an event is low. Each county has emergency action plans on file for each of the dams listed above. These emergency action plans include specific information on flood damages if either of these dams failed. However, for example if a dam like Bull Lake failed, Fremont County and Region 5 as a whole would be significantly impacted. Several lives could be lost as well though the probability of such an event is low. Dam failure can affect the Wind River Reservation significantly, see the Wind River Annex for additional details.

People

The population affected by the possibility of dam failure can be estimated using the count of residential buildings within known inundation areas multiplied by U.S. Census-based average household size values. Fremont county has an average of 2.6 people per household. Sublette county has an average of 2.74 people per household. Population at risk estimates are included in Table 4-9 below. This model underestimates the true population at risk because it is limited to privately owned dam inundation areas and also does not estimate non-residential populations.

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable timeframe. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have adequate warning from a television or radio emergency warning system.

Property

Vulnerable properties are those within and close to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect.

Communities located below a high or significant hazard dam and along a waterway are potentially exposed to the impacts of a dam failure. High hazard dams threaten lives and property, while significant hazard dams threaten property only. Inundation maps that identify anticipated flooded areas (which may not coincide with known floodplains) have been produced for privately owned high hazard dams; federal dams inundation data is considered sensitive and not included in this public document. Table 4-9 below displays the number of structures in dam inundation areas of privately owned dams within the Region and their values; all of these are in Fremont County and portions of the Wind River Reservation.

Table 4-9 Region 5 Parcels at Risk to Privately Owned High Hazard Dam Inundation by County and Jurisdiction

Jurisdiction	Property Type	Improved Parcels	Population
Hudson	Agricultural	1	
	Commercial	2	
	Residential	63	164
	Total	66	164
Lander	Commercial	121	
	Residential	916	2,382
	Total	1,037	2,382
Riverton	Commercial	1	
	Total	1	0
	Agricultural	3	

Jurisdiction	Property Type	Improved Parcels	Population
Unincorporated Fremont County	Commercial	29	
	Residential	285	741
	Total	317	741
	Grand Total	1,421	3,286

Source: Wyoming State Engineer's Office, Wyoming CAMA 2021, Wood GIS Analysis

Critical Facilities and Lifelines

A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical infrastructure. Any critical asset located under the dam in an inundation area would be susceptible to the impacts of a dam failure. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. Roads closed due to floods caused by dam failure or incident could result in serious transportation disruptions due to the limited number of roads in the county. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Based on the critical facility inventory considered in the updating of this plan and intersected with the dam inundation extents available, 40 critical facilities were found to be potentially at risk in Region 5. These facilities are listed in Table 4-10 below by jurisdiction and critical facility classification as based on the FEMA Lifeline categories (FEMA Community Lifelines, 2022). Fremont County has the largest number of potentially affected lifelines in the Transportation, Communications, Safety and Security sectors. Note that inundation maps for federal dams are not publicly available, including inundation for the dams in Sublette County. The majority of the transportation features are bridges, which could compromise response and recovery if damaged from a failure event.

Table 4-10 Fremont County Critical Facilities at Risk to Privately Owned High Hazard Dam Inundation by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Lander	12	-	-	-	1	9	2	24
Unincorporated	1	3	-	-	-	-	12	16
Total	13	3	0	0	1	9	14	40

Source: Wyoming State Engineer's Office, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Economy

Extensive and long-lasting economic impacts could result from a major dam failure or inundation event, including the long-term loss of water in a reservoir, which may be critical for potable water needs. A major dam failure and loss of water from a key structure could bring about direct business and industry damages and potential indirect disruption of the local economy. A dam failure can have long lasting economic impacts and could deter visitors for a period of time.

Environmental and Cultural Resources

Reservoirs held behind dams affect many ecological aspects of a river. River topography and dynamics depend on a wide range of flows, but rivers below dams often experience long periods of very stable flow conditions or saw-tooth flow patterns caused by releases followed by no releases. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of riverbeds and banks.

The environment would be vulnerable to a number of risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways, potentially causing the destruction of downstream habitats.

Development Trends

As communities or unincorporated areas grow, previously lower-classified dams may pose greater risks, which could elevate their hazard classification. Inundation maps and emergency action plans should be consulted in the planning of new development, where applicable. Growth rates in the region do not indicate that risk is increasing substantially.

Risk Summary and Overall Significance by Jurisdiction

Overall, dam failure significance ranges from high to low dependent upon location in the Region. The probability of such an event is low, but impacts could be significant depending upon the dam involved and where it occurred in the region. Wind River Reservation tribes consider this High significance due to the two high hazard dams located within the Reservation.

Table 4-11 Dam Failure Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Limited	Occasional	Limited	Medium
Sublette	Limited	Occasional	Limited	Medium
Wind River Reservation	Significant	Occasional	Critical	High

4.2.4 Drought

Hazard/Problem Description

Drought is described as a protracted period of deficient precipitation resulting in extensive damage to vegetation. Of all the natural weather-related disasters, drought is by far the most costly to society. It indirectly kills more people and animals than the combined effects of hurricanes, floods, tornadoes, blizzards, and wildfires. And, unlike other disasters that quickly come and go, drought's long-term unrelenting destruction has been responsible in the past for mass migrations and lost civilizations. The 1980 and 1988 droughts in the US resulted in approximately 17,500 heat-related deaths and an economic cost of over \$100 billion. Drought occurs in four stages and is defined as a function of its magnitude (dryness), duration, and regional extent. Severity, the most commonly used term for measuring drought, is a combination of magnitude and duration.

The first stage of drought is known as a meteorological drought. The conditions at this stage include any precipitation shortfall of 75% of normal for three months or longer. The second stage is known as agricultural drought. Soil moisture is deficient to the point where plants are stressed and biomass (yield) is reduced. The third stage is the hydrological drought. Reduced stream flow (inflow) to reservoirs and lakes is the most obvious sign that a serious drought is in progress. The fourth stage is the socioeconomic

drought. This final stage refers to the situation that occurs when physical water shortage begins to affect people.

As these stages evolve over time, the impacts to the economy, society, and environment converge into an emergency situation. Without reservoir water to irrigate farms, food supplies are in jeopardy. Without spring rains for the prairie grasslands, open range grazing is compromised. Without groundwater for municipalities, the hardships to communities result in increases in mental and physical stress as well as conflicts over the use of whatever limited water is available. Without water, wetlands disappear. The quality of any remaining water decreases due to its higher salinity concentration. There is also an increased risk of fires, and air quality degrades as a result of increased soil erosion particles in strong winds (blowing dust).

Geographical Area Affected

According to estimates by the Region 5 Hazard Mitigation Plan Committee, the Region is at high risk to drought events over an extensive spatial area. Droughts are often regional events, impacting multiple counties and states simultaneously. Therefore, as the climate of the planning area is fairly contiguous, it is reasonable to assume that a drought will impact the entire planning region. According to the Wyoming State Climate Office, Wyoming is the 5th driest state in the U.S. Drought can be a normal occurrence in Wyoming due to the State's natural climate. Based on this information, the geographic extent rating for drought in Region 5 is extensive. The Region is considered a headwaters source due to the snowpack in the Wind River Range upon which most of the region depends on for available water supplies in streams and reservoirs.

Past Occurrences

The planning area has experienced several multi-year droughts over the past several decades. The most recent statewide drought started in 1999 but began in earnest in the spring of 2000 and endured through 2004. 2005 was a wetter year, technically signifying the end of the drought period. Dry conditions returned in the following years and became especially severe between 2006 and 2007. According to the Wyoming State Climate Office, "conditions have eased somewhat in mid-2008, but a near decade with warm temperatures and relatively little precipitation has left [Wyoming] very vulnerable" (<http://www.wrds.uwyo.edu/sco/drought/drought.html>). Another particularly dry year occurred in 2012.

The 1999-2004 drought is considered by many to be the most severe in collective memory. However, some older residents have indicated that they remember streams drying up in the 1930s and 1950s. According to instrument records, since 1895 there have been only seven multi-year (three years or longer) statewide droughts. Based on deficit precipitation totals (negative departures from the long-term average), they are ranked statewide. Refer to Table 4-12.

Table 4-12 Significant Multi-Year Wyoming Droughts of the Modern Instrumented Era

Years	Average Annual Precipitation (inches)	Percent of 1985-2006 Average Annual Precipitation (13.04")
1952-1956	10.65	81.69%
1900-1903	10.76	82.52%
1999-2004	11.07	84.89%
1987-1990	11.12	85.28%
1958-1964	11.67	89.49%
1974-1977	11.77	90.26%

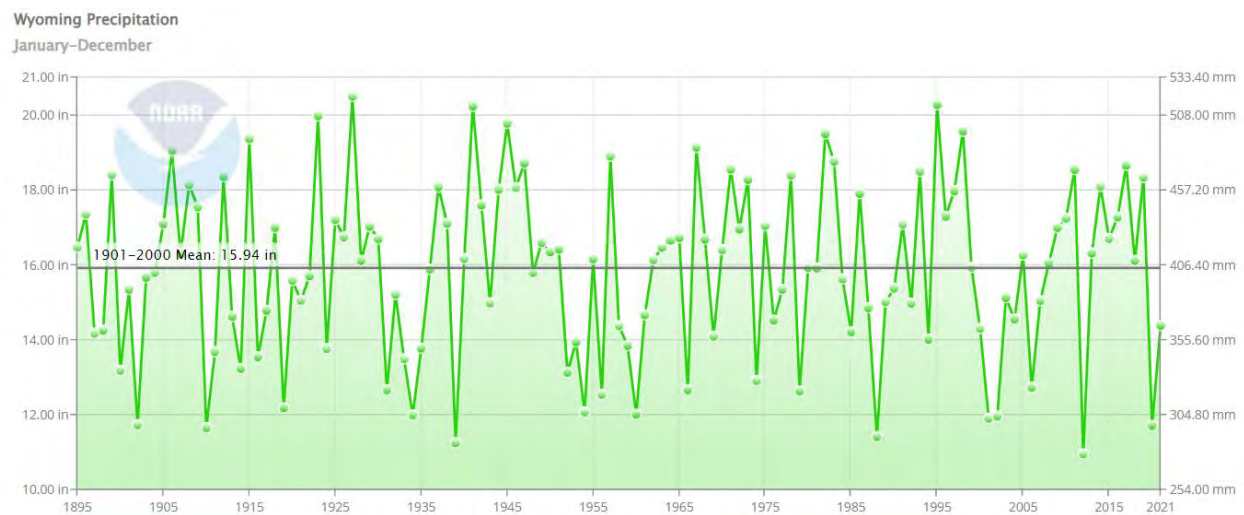
Years	Average Annual Precipitation (inches)	Percent of 1985-2006 Average Annual Precipitation (13.04")
1931-1936	11.79	90.41%

Source: Wyoming State Climate Office

Widespread droughts in Wyoming, as determined from stream flow records, were most notable during three periods: 1929-1942, 1948-1962, and 1976-1982.

As a whole, Wyoming's precipitation records from 1895-2017 reveals that, for the first half of the 20th century (except for the Dust Bowl years of the 1930s), there was generally a surplus of moisture. During the second half of the 20th century and into the 21st century there was an increasing trend of increased periods of drought (Figure 4-9).

Figure 4-9 Wyoming Annual Precipitation: 1895-2021

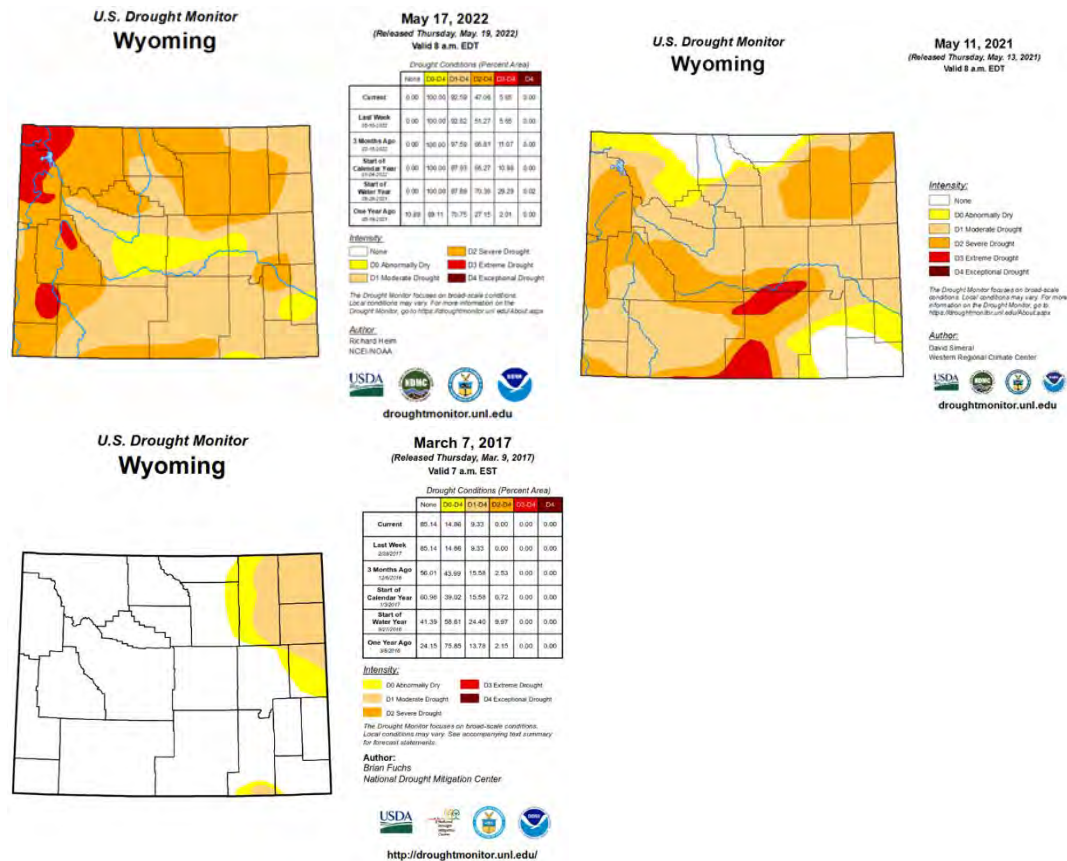


Source: <http://www.ncdc.noaa.gov/cag/time-series/>

The U.S. Drought Monitor (USDM) provides a general summary of current drought conditions. The U.S. Department of Agriculture (USDA), the National Oceanic and Atmospheric Administration (NOAA), and the National Drought Mitigation Center (University of Nebraska-Lincoln) collaborate on this weekly product, which is released each Thursday. Multiple drought indicators, including various indices, outlooks, field reports, and news accounts are reviewed and synthesized. In addition, numerous experts from other agencies and offices across the country are consulted. The result is the consensus assessment presented on the USDM map. The image is color-coded for four levels of drought intensity. An additional category, "Abnormally Dry," is used to show areas that might be moving into a drought, as well as those that have recently come out of one. The dominant type of drought is also indicated (i.e., agricultural and/or hydrological). (Source: <http://www.drought.unl.edu/dm/index.html>)

As of May 17, 2022, abnormally to extensive drought conditions were identified in the Region. The following drought monitor graphics (Figure 4-10) show how intensity and coverage varies over the region and how drought conditions changed in that period of time.

Figure 4-10 U.S. Drought Monitor (May 2022, May 2021, March 2017)



Another useful resource to determine the impacts of drought is the Drought Impact Reporter (DIR), launched by the National Drought Mitigation Center in July 2005 as the nation's first comprehensive database of drought impacts. The Drought Impact Reporter is an interactive web-based mapping tool designed to compile and display impact information across the United States in near real-time from a variety of sources such as media, government agencies, and the public. Information within the Drought Impact Reporter is collected from a variety of sources including the media, government agencies and reports, and citizen observers. Each of these sources provides different types of information at different spatial and temporal scales. (Source: <http://drought.unl.edu/monitoringtools/droughtimpactreporter.aspx>)

A search of the database for Region 5 from 2000-2021 (which includes the most recent severe droughts) shows a total of 30 reported impacts. The figures below show the breakdown of reported impacts by county; specific impacts were not available for the Reservation. The most reported impacts (18) are in the Relief, Response and Restrictions category followed by the Agricultural Category. Drought effects associated with agriculture include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; reduced productivity of rangeland; forced reduction of foundation stock; and closure/limitation of public lands to grazing, among others. The Relief, Response & Recovery category refers to drought effects associated with disaster declarations, aid programs, requests for disaster declaration or aid, water restrictions, or fire restrictions.

Figure 4-11 Number of Reported Drought Impacts 2000-2021 Fremont County

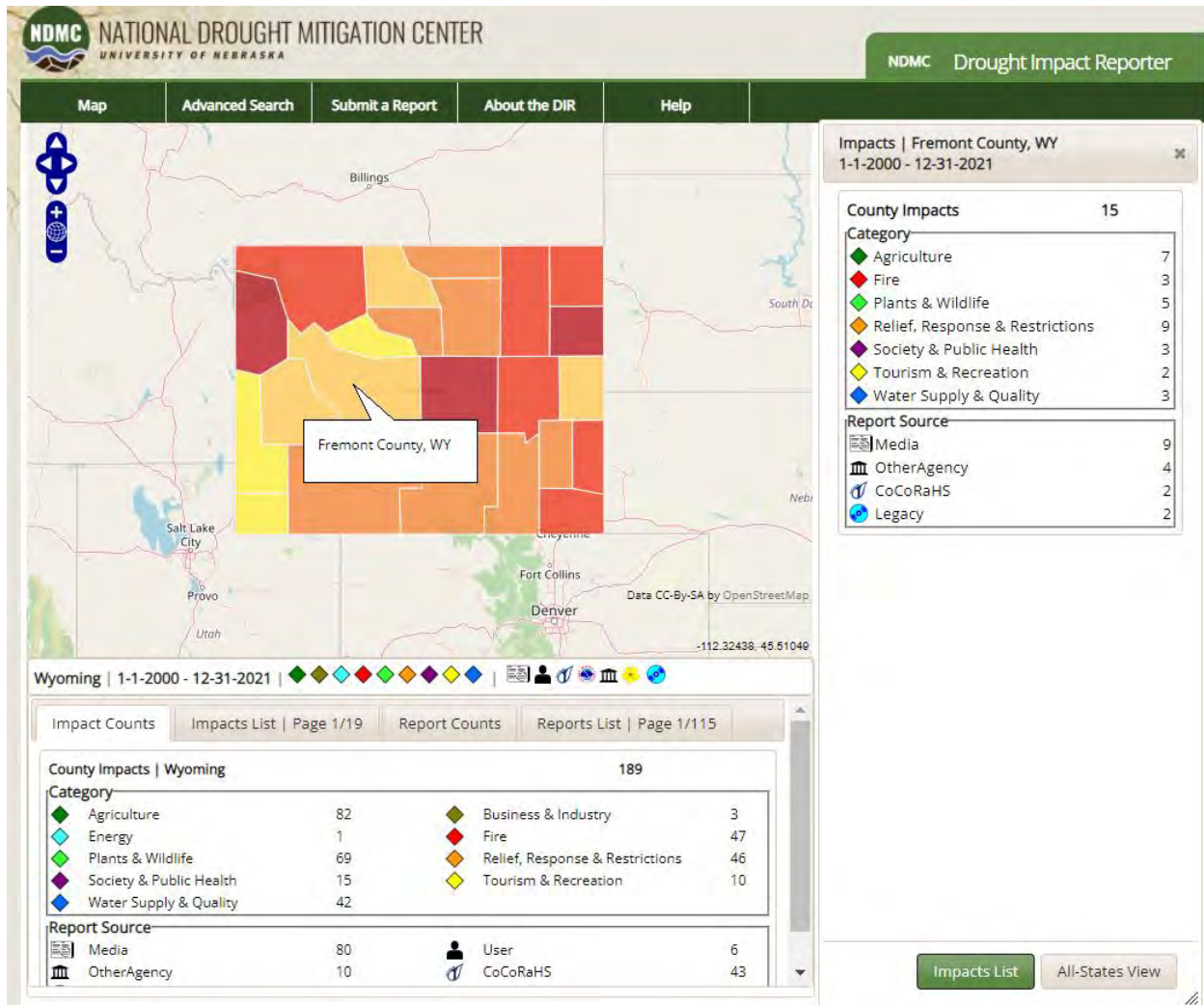
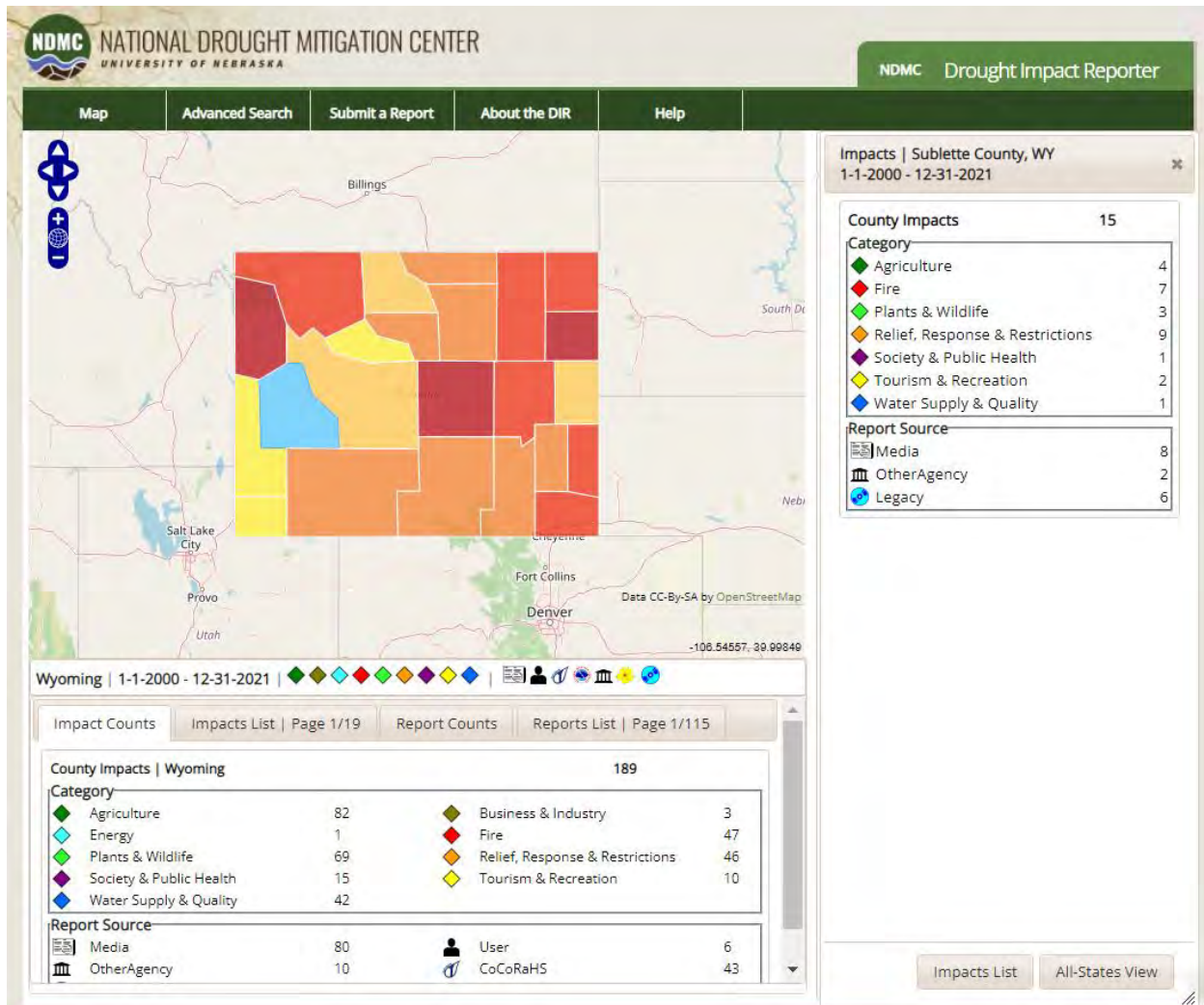


Figure 4-12 Number of Reported Drought Impacts 2000-2021 Sublette County



All areas in Region 5 have, at various times, been included in regional USDA disaster designations for droughts. Between 2012 and 2021 the Region had 19 disaster designations. In November 2007, the USDA designated 11 counties as natural disaster areas for drought including Big Horn, Converse, Fremont, Hot Springs, Lincoln, Niobrara, Platte, Sublette, Sweetwater, Washakie and Weston. An ongoing drought declaration was made in December 2007 for Wyoming. Originally, this declaration was directed at Park County but was extended to the contiguous counties of Big Horn, Fremont, Hot Springs, Teton, and Washakie.

Some examples of losses during a drought include a report in 2012 involving agricultural loss reported "Ranchers grazing their cattle on Bureau of Land Management property in western Wyoming were anxious about losing their permission to have their cattle on BLM land because riparian lands were deteriorating from drought. The vice president of the Wyoming Stock Grower's Association stated that many of those producers do not have anywhere else to send their cattle." (Casper Star-Tribune, July 8, 2012). Affected areas included Big Horn County, Fremont County, Hot Springs County, Sublette County, Sweetwater County, Uinta County and Washakie County.

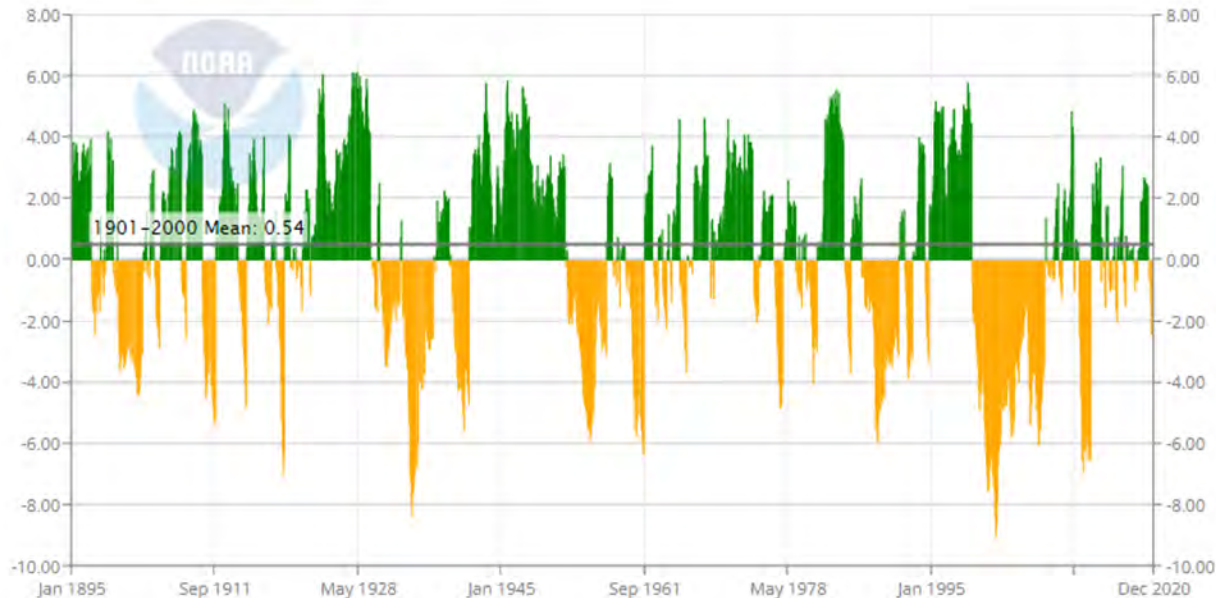
Another account of agricultural loss in a drought includes an April 2013 article regarding the curbing of alfalfa hay production by 39 percent in Fremont County. "Drought curbed alfalfa hay production by 38 percent in Fremont County in 2012 when 157,000 tons of hay were produced with an average yield of 2.7 tons per acre." (Billings Gazette, April 21, 2013).

Frequency/Likelihood of Future Occurrence

Figure 4-13 indicates that drought occurs approximately every five to 10 years in Region 5. Figure 4-13 indicates the planning area spent approximately 15-20% of the 100-year span from 1895 to 1995 in severe or extreme drought; Sublette County falls in the 20% or greater category. This is consistent with the data in the Past Occurrences subsection which suggests that severe multi-year droughts have occurred roughly every ten years since the mid-20th century. An occurrence interval of roughly once every ten years corresponds to a likely frequency of occurrence. This is consistent with HMPC estimates.

Figure 4-13 Palmer Drought Severity Index Time Series for the Continental U.S.: 1895-2020

Wyoming Palmer Drought Severity Index (PDSI)



Potential Magnitude (Extent)

In order to calculate a magnitude and severity rating for comparison with other hazards, and to assist in assessing the overall impact of the hazard on the planning area, information from the event of record is used. In some cases, the event of record represents an anticipated worst-case scenario, and in others, it is a reflection of a common occurrence. Based upon Table 4-13 and Table 4-14, the drought of 1999-2004 is as significant, if not more significant than any other droughts in the last 100 years for the entire state. The droughts noted previously in Table 4-12, derived from the Wyoming Climate Atlas, indicates that the most significant droughts in the last century, in terms of precipitation deficit, were in 1952-1956 and 1999-2004. In order to determine which drought period had the most significant impact on Wyoming, crop production and livestock inventory data for the two periods were compared. 1957 and 2005 were wetter years, with annual statewide precipitation totals above the 1895-2015 average. Those two years were used as endpoints for the droughts that started in 1952 and 1999 respectively. In both cases, the years following saw a return to drier conditions. Because of this, the most recent drought impacts were also calculated for 2005 and

2006 and are included in summary tables. Table 4-13 and Table 4-14 show peak decline (%) in production during drought compared to the 5-year pre-drought production average for various commodities.

A comparison of Table 4-13 and Table 4-14 indicate that drought impacts to the Wyoming agricultural community were greater in the 1999-2004 drought than in the 1952-1956 drought. With the exception of dry beans, all commodities in the worst years of the 1999-2004 drought showed a greater percentage decline in production than in the 1952-1956 drought. As a result, the 1999-2004 drought will be used as the drought of historic record to calculate dollar impacts.

Table 4-13 Peak Commodity Production Changes from Pre-Drought (1947-1951) to Drought (1952-1956)

Commodity	5-Year Pre-Drought Production Average (1947-1951)	Units	Lowest Production During Drought (1952-1956)	Year of Lowest Production (1952-1956)	Percent Change
Winter Wheat	5,072	1,000 bu.	2,346	1954	-54%
Spring Wheat	1,579	1,000 bu.	600	1954	-62%
Barley	4,414	1,000 bu.	2,700	1956	-39%
Oats	4,577	1,000 bu.	2,470	1954	-46%
Dry Beans	1,009	1,000 cwt.	589	1955	-42%
Sugarbeets	413	1,000 tons	421	1955	+2%
Corn	227	1,000 bu.	161	1953	-29%
Alfalfa Hay	490	1,000 tons	675	1954	+38%
Other Hay	674	1,000 tons	442	1954	-34%
Cattle/ Calves Inventory	1,050	1,000 head	1,096	1954	+4%

Source: USDA

Table 4-14 Peak Commodity Production Changes from Pre-Drought (1994-1998) to Drought (1999-2004)

Commodity	5-Year Pre-Drought Production Average (1994-1998)	Units	Lowest Production During Drought (1999-2006)	Year of Lowest Production (1999-2006)	Percent Change
Winter Wheat	6,029	1,000 bu.	2,375	2002	-61%
Spring Wheat	648	1,000 bu.	96	2002	-84%
Barley	8,383	1,000 bu.	4,680	2002	-44%
Oats	1,648	1,000 bu.	600	2005	-64%
Dry Beans	691	1,000 cwt.	514	2001	-26%
Sugarbeets	1,151	1,000 tons	659	2002	-43%
Corn	6,328	1,000 bu.	4,165	2002	-34%
Alfalfa Hay	1,581	1,000 tons	1,150	2002	-27%
Other Hay	817	1,000 tons	450	2002	-45%
Cattle/ Calves Inventory	1,536	1,000 head	1,300	2004	-16%

Source: USDA

The U.S. Drought Monitor classifies droughts into different categories, from D0 (Abnormally Dry) to D4 (Exceptional Drought), as shown in Figure 4-14. Periods of dryness are classified in one of these categories as the drought's life cycle is tracked. The following figure explains each of these categories. All drought categories can and have been experienced in the Region.

Figure 4-14 Drought Severity Classifications, U.S. Drought Monitor

Category	Description	Possible Impacts	Ranges				
			Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	- Going into drought: - short-term dryness slowing planting, growth of crops or pastures - Coming out of drought: - some lingering water deficits - pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	- Some damage to crops, pastures - Streams, reservoirs, or wells low, some water shortages developing or imminent - Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	- Crop or pasture losses likely - Water shortages common - Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	- Major crop/pasture losses - Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	- Exceptional and widespread crop/pasture losses - Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: U.S. Drought Monitor

Changing Future Conditions

According to analysis by FEMA Region VIII on the projected changes in natural hazards frequency and intensity, the areas in the state at risk to drought are not expected to change in the future, though drought is projected to increase in intensity and frequency. Seasonal precipitation patterns are projected to shift, leading to dryer summers and less precipitation as snow in early spring and late fall seasons. This, coupled with earlier spring runoff, is projected to result in longer duration in droughts statewide.

Vulnerability Assessment

The vulnerability of the people, buildings, and economy of Region 5 to drought is very difficult to quantify. Typically, people and structures are not directly vulnerable to drought, though secondary or indirect impacts may eventually increase vulnerability ratings. However, some areas are more vulnerable overall than others and, therefore, benefit from adequate mitigation planning and implementation. For Region 5, the agricultural sector is the most vulnerable to drought and will benefit the most from mitigation efforts. Economic resources tied to agricultural production are extremely vulnerable to drought. Outdoor recreation, which is important to the Region 5 economy, is also vulnerable to drought. The geographic extent of the hazard is considered extensive. The probability of future occurrences is considered likely, and the potential magnitude/severity is high. In addition, the HMPC considers the hazard to have an overall impact rating of high for the County.

Vulnerability is tempered somewhat by the Region being a headwaters area. The snowpack in the Wind River Range helps feed rivers and streams during normal years, but can be affected by dry, low snowpack years.

People

The historical and potential impacts of drought on populations include agricultural sector job loss, secondary economic losses to local businesses and public recreational resources, increased cost to local and state government for large-scale water acquisition and delivery, and water rationing and water wells running dry for individuals and families. As drought is often accompanied by prolonged periods of extreme heat, negative health impacts such as dehydration can also occur, where children and elderly are most susceptible. Other public health issues can include impaired drinking water quality, increased incidence of mosquito-borne illness, an increase in wildlife-human confrontations and respiratory complications as a result of declined air quality in times of drought.

Property

Direct structural damage from drought is rare, though it can happen. Drought can affect soil shrinking and swelling cycles and can result in cracked foundations and infrastructure damage. Droughts can also have significant impacts on landscapes, which could cause a financial burden to property owners. However, these impacts are not considered critical in planning for impacts from the drought hazard.

Critical Facilities and Lifelines

Critical facilities as defined for this plan will continue to be operational during a drought. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

Economy

Economic impact will be largely associated with industries that use water or depend on water for their business. For example, landscaping businesses were affected in the droughts of the past as the demand for service significantly declined because landscaping was not watered. Agricultural industries will be impacted if water usage is restricted for irrigation. According to the USDA 2017 Census of Agriculture, the combined market value of crops and livestock sold in the Region was \$135,299,000, representing a 12% to 20% decrease since the 2012 Census of Agriculture (USDA). While there are several factors that affect market value, 2017 was a moderate drought year and its likely this is reflected in part in the decrease. Drought and extreme heat may impact all crops grown in the Region and the pastureland used to sustain livestock.

The 1999-2004 drought can be shown to be the drought of historic record. There have been significant impacts on the agricultural industry from the 1999-2004 drought. The worst-case year was 2002, with a negative dollar impact of \$308,171,390 statewide. Region 5 is 14.5% of the State of Wyoming in land area. If it is assumed that the drought impact is equally distributed across the state, which in reality it is not, the potential drought impact in Region 5 for 2002 would be approximately \$45 million. The total impact statewide for the 1999-2004 drought is \$903,649,936. If it is assumed that the drought impact is equally distributed across the state, which in reality it is not, then the potential drought impact in Region 5 would be approximately \$131,189,890.

Additionally, drought can exacerbate the risk of wildfires; increase the cost of municipal water usage; and deplete water resources used for recreation, affecting the economy.

Environmental and Cultural Resources

Environmental losses from drought are associated with damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife

habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

Development Trends

Future development in the Region is not anticipated to change vulnerability to drought significantly.

Risk Summary and Overall Significance by Jurisdictions

Drought is considered a high significance hazard for most of the Region due to the extensive economic and environmental impacts. Drought can be widespread and pervasive for several years and exacerbate other hazards such as wildfire.

Table 4-15 Drought Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Significant	Likely	Critical	High
Sublette	Significant	Likely	Critical	High
Wind River Reservation	Significant	Likely	Critical	High

4.2.5 Flood

Hazard/Problem Description

Floods can and have caused significant damage in Region 5 and are one of the more significant natural hazards in the Region. They have caused millions of dollars in damage in just a few hours or days. A flood, as defined by the National Flood Insurance Program, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of waters; unusual and rapid accumulation or runoff of surface waters from any source; or, a mudflow. Floods can be slow or fast rising, but generally develop over a period of many hours or days. Causes of flooding relevant to the Region include:

- Rain in a general storm system
- Rain in a localized intense thunderstorm
- Melting snow
- Rain on melting snow
- Urban stormwater drainage
- Ice Jams
- Dam failure
- Levee Failure
- Rain on fire damaged watersheds

The area adjacent to a river channel is its floodplain. In its common usage, "floodplain" most often refers to that area that is inundated by the 100-year flood, the flood that has a 1 percent chance in any given year of being equaled or exceeded. The 100-year flood is the national standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP).

Region 5 is susceptible to multiple types of floods including riverine flooding, flash floods, slow rise floods, ice jams and possibly dam or levee failure.

Riverine flooding is defined as when a watercourse exceeds its “bank-full” capacity and is usually the most common type of flood event. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. Slow rise floods associated with snowmelt and sustained precipitation usually are preceded with adequate warning, though the event can last several days.

Floods can also occur with little or no warning and can reach full peak in only a few minutes. Such floods are called flash floods. A flash flood usually results from intense storms dropping large amounts of rain within a brief period. Flash floods, by their nature, occur very suddenly but usually dissipate within hours. Even flash floods are usually preceded with warning from the National Weather Service in terms of flash flood advisories, watches, and warnings.

Floods can occur for reasons other than precipitation or rapidly melting snow. They can also occur because of ice jams. An ice jam is a stationary accumulation of ice that restricts flow. Ice jams can cause considerable increases in upstream water levels, while at the same time downstream water levels may drop. Types of ice jams include freeze up jams, breakup jams, or combinations of both. These types of floods can be slow or fast rising, but generally develop over a period of many hours or days.

Levee failure can also cause a flash flood and is a risk in the region. A levee is an earthen embankment constructed along the banks of rivers to protect adjacent lands from flooding by reinforcing the banks. It is also important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

The potential for flooding can also change and increase through various land use changes and changes to land surface. A change in the built environment can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels. These changes are commonly created by human activities. Flooding in the communities in Region 5 could be exacerbated by inadequate drainage and channel systems that would not stand up to the 1% annual chance flood. Inadequate culverts and drainage systems can cause flooded roads and flood adjacent properties. Refer to the county and reservation annexes for a description of localized problems.

Increased flooding can also be created by other events such as wildfires. Wildfires create hydrophobic soils, a hardening or “glazing” of the earth’s surface that prevents rainfall from being absorbed into the ground, thereby increasing runoff, erosion, and downstream sedimentation of channels.

Geographical Area Affected

All counties and the reservation within the planning region have the potential for flooding. The extent of the flooding varies based on the location of the county/reservation, and on what part of the county/reservation is being examined. Detailed geographic flood assessments are provided in each attached county/reservation annex.

The counties of Region 5 and Wind River Reservation are predominantly located in the Wind/Big Horn River Basin and the Green River Basin of Wyoming. The southern portion of Fremont County lies in the northwest handle of the Platte River Basin.

The Wind River originates in the mountainous terrain between the Absaroka and Wind River Ranges and flows southeast through the Wind River Reservation and Fremont County. At Riverton the river turns north, flowing through high desert, and forms Boysen reservoir (in Fremont County) with a capacity of over 800,000 acre-ft. Once the river exits the Wind River Canyon near Thermopolis, it becomes the Bighorn River which continues northward, passing through Hot Springs, Washakie, and Big Horn Counties.

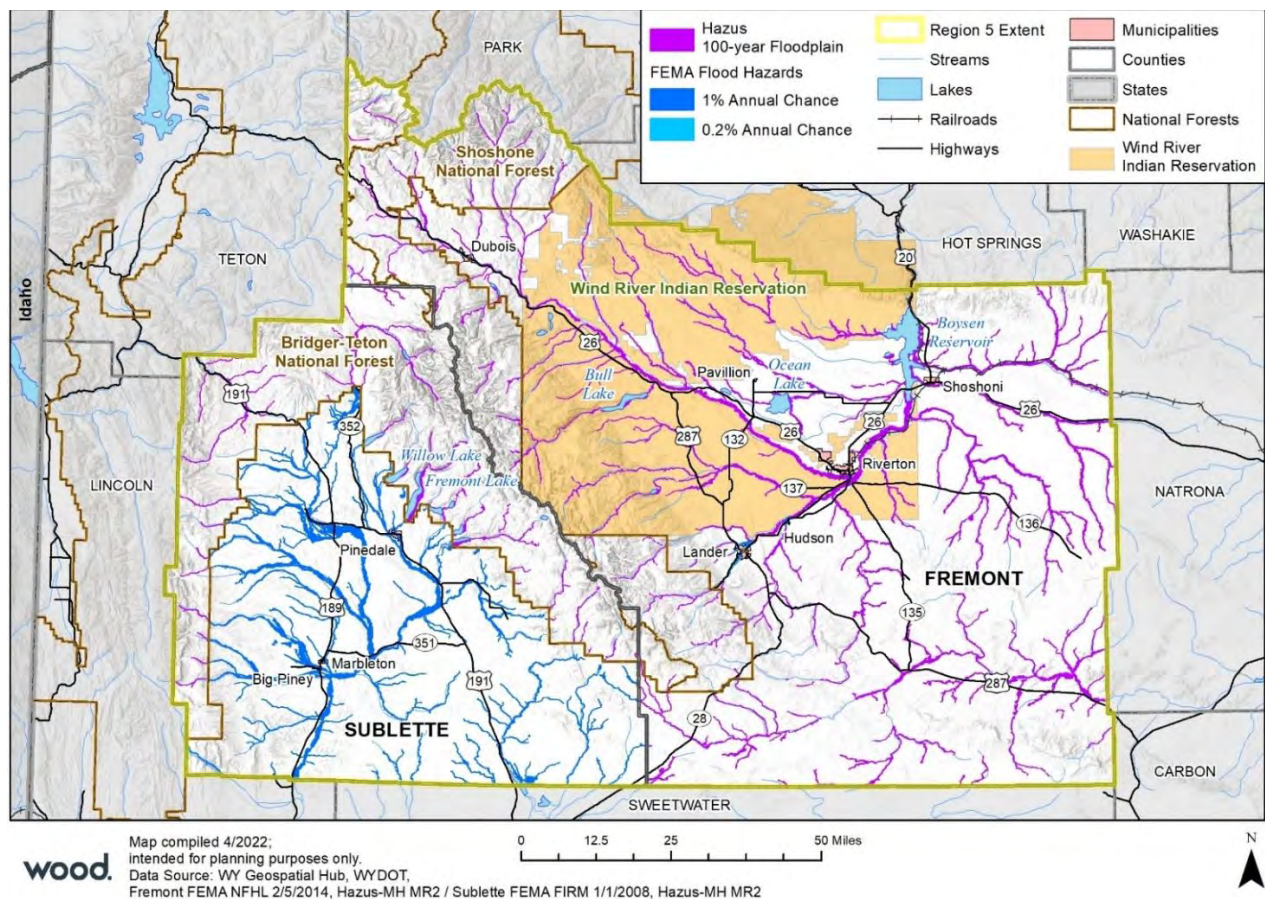
The Little Popo Agie River has its source in the Wind River Mountains, approximately 50 miles to the southwest of Hudson. The Little Popo Agie River flows into the Popo Agie River outside the northwest corner of Hudson. Hudson Draw, an ephemeral stream, flows from the east into the Little Popo Agie River in the southwest-central part of Hudson. The Middle Fork Popo Agie River flows through Sinks Canyon and through the Town of Lander.

The drainage area of Horse Creek in the Town of Dubois was determined to be 120 square miles. The mean annual precipitation for the Horse Creek Basin was determined to be 16 inches.

The geographic extent rating for Region 5 is **significant**, meaning that a flood event could impact 10-50% of the planning area. The following sections detail the extent and history of flood hazards in the Region.

Figure 4-15 shows the Region 5 Flood Hazards. More detailed mapping is shown in the county and reservation annexes.

Figure 4-15 Region 5 Flood Hazards



Past Occurrences

A brief history of significant floods in the Region is presented below. A damaging flood occurs in the area every year on average, based upon the historical data presented below

Table 4-16 Fremont County NCEI Flood Events

Type	Location	Date	Property Damage	Crop Damage
Flood	DUBOIS	9/12/1998	\$0	\$0
Flood	RIVERTON	9/12/1998	\$0	\$0
Flood		6/19/1999	\$0	\$0
Flood	LOST CABIN	6/5/2008	\$25,000	\$0
Flood	SINKS CANYON SP	6/4/2010	\$12,000,000	\$0
Flood	SWEETWATER STATION	5/22/2011	\$0	\$30,000
Flood	RIVERTON	6/24/2011	\$415,000	\$250,000
Flood	RIVERTON	7/1/2011	\$100,000	\$500,000
Flood	DUBOIS MUNI ARPT	5/28/2014	\$0	\$0
Flood	RIVERTON	5/28/2014	\$0	\$0
Flood	DUBOIS MUNI ARPT	6/1/2014	\$0	\$0
Flood	RIVERTON	6/1/2014	\$0	\$0
Flood	UNION PASS SUBDVSN	6/2/2015	\$0	\$0
Flood	RIVERTON	6/2/2015	\$0	\$0
Flood	RIVERTON	6/6/2015	\$0	\$0
Flood	RIVERTON	6/17/2015	\$0	\$0
Flood	SWEETWATER STATION	5/7/2016	\$1,200,000	\$0
Flash Flood	(LND)HUNT FLD LANDER	2/9/2017	\$20,000	\$0
Flash Flood	HUDSON	2/10/2017	\$100,000	\$0
Flash Flood	LANDER	2/10/2017	\$0	\$0
Flash Flood	RIVERTON	2/10/2017	\$0	\$0
Flash Flood	RIVERTON	2/21/2017	\$10,000	\$0
Flash Flood	DUBOIS MUNI ARPT	6/3/2017	\$0	\$0
Flash Flood	ARAPAHOE	6/3/2017	\$0	\$0
Flash Flood	(LND)HUNT FLD LANDER	6/3/2017	\$0	\$0
Flash Flood	HUDSON	6/3/2017	\$0	\$0
Flash Flood	ST STEPHENS	6/3/2017	\$0	\$0
Flash Flood	CROWHEART	6/4/2017	\$0	\$0
Flash Flood	MORTON	6/4/2017	\$0	\$0
Flash Flood	MORTON	6/7/2017	\$0	\$0
Flash Flood	DUBOIS MUNI ARPT	5/27/2018	\$0	\$0
Flash Flood	KINNEAR	5/28/2018	\$0	\$0
Flash Flood	KINNEAR	6/18/2018	\$0	\$0
Flash Flood	LANDER	6/7/2019	\$0	\$0
Flash Flood	FT WASHAKIE	6/7/2019	\$0	\$0
Flash Flood	UNION PASS SUBDVSN	6/1/2020	\$0	\$0

Type	Location	Date	Property Damage	Crop Damage
Flash Flood	WILLOW CREEK	6/29/2020	\$0	\$0
Flash Flood	RIVERTON	6/30/2020	\$0	\$0
		Total	\$13,870,000	\$780,000

Source: NCEI Data

Table 4-17 Sublette County NCEI Flood Events

Type	Location	Date	Property Damage	Crop Damage
Flood	LANDER FOOTHILLS / C FREMONT (ZONE)	6/19/1999	\$0	\$0
Flood	SUBLETTE CO.	7/1/2011	\$0	\$0
Flood	SUBLETTE CO.	7/1/2011	\$50,000	\$0
Flood	SUBLETTE CO.	3/12/2017	\$0	\$0
Flood	SUBLETTE CO.	6/5/2017	\$0	\$0
Flood	SUBLETTE CO.	6/5/2017	\$0	\$0
		Total	\$50,000	\$0

Source: NCEI Data

The Wind River Indian Reservation has experienced a number of small to moderate floods over the past 100 years. Flooding occurred on the reservation in 1892, 1917, 1918, 1923, 1935, 1963, 1964, 1978, 1981, 1991, 1995, and 1996. Scant details were found for floods up until 1991, with a few exceptions.

The flood of 1923 was widespread; peak discharges during the snowmelt were estimated to have a recurrence interval that exceeded 100 years. This flood caused millions in damage, including \$1 million in damages to the Chicago and Northwestern Railroad. This event caused 20 deaths, statewide.

The flood of 1963 affected most basins in north-central Wyoming. The snowmelt was receding when rainfall began on June 14, causing rapid snowmelt, rapidly melting the remaining snowpack, resulting in regional flooding, which may have been the worst flooding to occur on the Wind River Reservation.

On March 2, 1974, a rapid snow melt combined with rain caused flooding along the Popo Agie River. There was also an ice jam that formed near Hudson that intensified flooding and forced 60 families to evacuate. Damage was estimated to be \$500,000.

According to SHELDUS, a 1981 flood occurred in Fremont County, causing \$250,000. No details are provided on which areas of the county were impacted.

In 1991, the Wind River Basin had a tremendous snowpack, with snowstorms occurring late into the spring. Abnormally high temperatures then occurred on June 2 causing rapid snowmelt, which was exacerbated by rains on June 1 and 2. All this led to the large snowpack coming down the canyons in two weeks rather than the normal four weeks. The town of Arapaho was particularly hard-hit, suffering flood losses on 12 structures. Losses on the Wind River Indian Reservation were estimated to be \$247,500, including losses to structures and the loss of crops along the river. The Governor of Wyoming declared an emergency and requested FEMA assistance in assessing damages. The Governor asked the President for a Major Disaster Declaration for seven counties, but the request was eventually denied.

In 1995, the Big Wind, Little Wind, and Popo Agie Rivers flooded causing damages to 11 houses, four of which were heavily damaged; five mobile homes were also damaged. Forty people were evacuated, and

one fatality occurred. Many damages were avoided due to the work of hundreds of volunteers, who sandbagged along rivers and next to houses.

In early 2017, ice jams caused flooding along the Little Wind River south of Riverton, causing impacts upstream and impacting the Reservation.

Frequency/Likelihood of Future Occurrence

Judging by the historical flood record for the Region, a flood of at least minimal magnitude occurs 2 times a year on average somewhere in the planning area. Most of these floods were less than the 100-year flood; the chance of a 100-year flood occurring within any 30-year period is 26%. The chance of a 100-year flood occurring in any 100-year period is approximately 63%. Using the formula in Section 4.2, this yields a 10-100 % probability. This corresponds to a **Likely** occurrence rating, meaning that a flood has a 10-100 percent chance of occurrence in the next year somewhere in the Region.

Changing Future Conditions

According to the 2021 Wyoming State Hazard Mitigation Plan and analysis conducted by FEMA Region VIII, flood hazard zones across the state are projected to increase in size. Intense storms and periods of heavy rain are also projected to increase in frequency across the state, which in turn could increase the frequency of flood events in Region 5.

Potential Magnitude (Extent)

Magnitude and severity can be described or evaluated in terms of a combination of the different levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding on Region 5 span a comprehensive range and are summarized as follows:

- Floods cause damage to private property that often creates financial hardship for individuals and families;
- Floods cause damage to public infrastructure resulting in increased public expenditures and demand for tax dollars;
- Floods cause loss of personal income for agricultural producers that experience flood damages;
- Floods cause loss of income to businesses relying on recreational uses of regional waterways;
- Floods cause emotional distress on individuals and families; and
- Floods can cause injury and death.

Floods present a risk to life and property, including buildings, their contents, and their use. Floods can affect crops and livestock. Floods can also affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies. The impact of a flood event can vary based on geographic location to waterways, soil content and ground cover, and construction. The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, and the time of year. Shallow flooding to flood depths of several feet are possible in the Region, depending on a variety of factors including the topography, runoff, rainfall rate and intensity.

Vulnerability Assessment

People

Vulnerable populations in Region 5 include residents living in known floodplains or near areas vulnerable to flash floods. Certain populations are particularly vulnerable. This may include the elderly and very young, those living in long-term care facilities, mobile homes, hospitals, low-income housing areas, or temporary shelters, people who do not speak English well, tourists and visitors, and those with developmental, physical, or sensory disabilities. These populations may be more vulnerable to flooding due to limitations of

movement, fiscal income, challenges in receiving and understanding warnings, or unfamiliarity with surroundings.

As part of this plan's preparation, an estimate of the population exposed to flooding was created using a GIS overlay of the National Flood Hazard Layer (NFHL) on potentially flooded parcels. The NFHL used for this GIS analysis was last updated December 3, 2020 and the FEMA FIRM's effective date is 02/05/2014 for Fremont County. Sublette County FEMA FIRM's effective date is 01/01/2008. Hazus-MH MR2 data that was made available in 2008 was also used to assess vulnerability in areas not covered by FEMA mapping.

The flood-impacted population for each county in the region was then calculated by taking the number of residential units in the 1% annual chance (100-year) and 0.2% annual chance (500-year) floodplains and multiplying that number by the average household size based on the Census Bureau's American Community Survey 2020 Census for the county. The average household factor is 2.6 in Fremont County and 2.74 in Sublette County. The results are displayed below in Table 4-18.

Table 4-18 Population Estimate in Region 5 by Flood Hazard and Jurisdiction

1% and 0.2% Annual Chance of Flooding	Fremont County	Sublette County	Wind River Reservation
1% Annual Chance Flood	1,537	1,085	806
0.2% Annual Chance Flood	151	0*	0*
Total Population	1,688	1,085	806

Sources: **Fremont** FEMA NFHL, (2/05/2014) & Hazus-MH MR2, Wyoming CAMA 2021, **Sublette** FEMA FIRM (1/1/2008) & Hazus-MH MR2, Wyoming CAMA 2021, Wood GIS Analysis, Hazus *0.2% not mapped for Sublette County

Property

GIS analysis was used to estimate Region 5's potential property and economic losses. The two county parcel layers were used as the basis for the inventory of developed parcels. GIS was used to create a centroid, or point, representing the center of each parcel polygon, which was overlaid on the best available floodplain layer. For the purposes of this analysis, the flood zone that intersected the centroid was assigned as the flood zone for the entire parcel. In some cases, there are parcels in multiple flood zones. Another assumption with this model is that every parcel with an improvement value greater than zero was assumed to be developed in some way. Only improved parcels, and the value of those improvements, were analyzed and aggregated by jurisdiction, property type and flood zone. The summarized results for the Region are shown below.

Table 4-19 and Table 4-20 below, both summarize the counts and improved value of parcels in the region for Fremont County, broken out by each jurisdiction, that fall within the 1% or 0.2% annual chance floodplains. Additionally, a loss estimate value is calculated based upon the improved value and estimated contents value. The estimated contents value is 50% of the improved value; the total value is the sum of the improved and estimated contents values; the loss estimate is 25% of the total value based on FEMA's depth-damage loss curves. For example, a two-foot flood generally results in about 25% damage to the structure (which translates to 25% of the structure's replacement value).

Table 4-19 Fremont County Parcels at Risk to 1% Annual Chance Flood Hazard by County and Jurisdiction

Jurisdiction	Property Type	Improved Parcels	Improved Value	Est. Content Value	Total Exposure	Estimated Loss	Pop.
Dubois	Commercial	2	\$76,038	\$76,038	\$152,076	\$38,019	
	Residential	53	\$8,348,298	\$4,174,149	\$12,522,447	\$3,130,612	138
	Total	55	\$8,424,336	\$4,250,187	\$12,674,523	\$3,168,631	138
Hudson	Agricultural	1	\$1,797	\$1,797	\$3,594	\$899	
	Commercial	5	\$504,660	\$504,660	\$1,009,320	\$252,330	
	Residential	42	\$2,097,849	\$1,048,925	\$3,146,774	\$786,693	109
	Total	48	\$2,604,306	\$1,555,382	\$4,159,688	\$1,039,922	109
Lander	Commercial	6	\$1,824,524	\$1,824,524	\$3,649,048	\$912,262	
	Residential	19	\$3,070,067	\$1,535,034	\$4,605,101	\$1,151,275	49
	Total	25	\$4,894,591	\$3,359,558	\$8,254,149	\$2,063,537	49
Riverton	Commercial	4	\$525,203	\$525,203	\$1,050,406	\$262,602	
	Residential	2	\$449,811	\$224,906	\$674,717	\$168,679	5
	Total	6	\$975,014	\$750,109	\$1,725,123	\$431,281	5
Unincorporated	Agricultural	3	\$49,106	\$49,106	\$98,212	\$24,553	
	Commercial	38	\$8,972,622	\$8,972,622	\$17,945,244	\$4,486,311	
	Residential	475	\$74,036,799	\$37,018,400	\$111,055,199	\$27,763,800	1,235
	Total	516	\$83,058,527	\$46,040,128	\$129,098,655	\$32,274,664	1,235
Grand Total		650	\$99,956,774	\$55,955,362	\$155,912,136	\$38,978,034	1,537

Source: Fremont FEMA NFHL 2/5/2014 & Hazus-MH MR2, Wyoming CAMA 2021, Wood GIS Analysis

Table 4-20 Fremont County Parcels at Risk to 0.2% Annual Chance Flood Hazard by County and Jurisdiction

Jurisdiction	Property Type	Improved Parcels	Improved Value	Est. Content Value	Total Exposure	Estimated Loss	Pop.
Hudson	Commercial	4	\$115,033	\$115,033	\$230,066	\$57,517	
	Residential	39	\$2,669,881	\$1,334,941	\$4,004,822	\$1,001,205	101
	Total	43	\$2,784,914	\$1,449,974	\$4,234,888	\$1,058,722	101
Lander	Commercial	3	\$4,947,912	\$4,947,912	\$9,895,824	\$2,473,956	
	Residential	12	\$2,839,863	\$1,419,932	\$4,259,795	\$1,064,949	31
	Total	15	\$7,787,775	\$6,367,844	\$14,155,619	\$3,538,905	31
Unincorporated	Commercial	3	\$361,317	\$361,317	\$722,634	\$180,659	
	Residential	7	\$996,896	\$498,448	\$1,495,344	\$373,836	18
	Total	10	\$1,358,213	\$859,765	\$2,217,978	\$554,495	18
Grand Total		68	\$11,930,902	\$8,677,582	\$20,608,484	\$5,152,121	151

Source: Fremont FEMA NFHL 2/5/2014, Wyoming CAMA 2021, Wood GIS Analysis

Table 4-21 and Table 4-22 summarizes the parcels within Sublette County and Wind River Reservation at risk to the 1% annual chance of flooding. As digital mapping of parcel data has expanded and improved, more parcels have been determined to be present within the unincorporated Sublette County flood hazard areas.

Table 4-21 Sublette County Parcels at Risk to 1% Annual Chance Flood Hazard by County and Jurisdiction

Jurisdiction	Property Type	Improved Parcels	Improved Value	Est. Content Value	Total Exposure	Estimated Loss	Pop.
Big Piney	Residential	1	\$62,533	\$31,267	\$93,800	\$23,450	3
	Total	1	\$62,533	\$31,267	\$93,800	\$23,450	3
Pinedale	Commercial	2	\$172,738	\$172,738	\$345,476	\$86,369	
	Residential	22	\$2,360,205	\$1,180,103	\$3,540,308	\$885,077	60
	Total	24	\$2,532,943	\$1,352,841	\$3,885,784	\$971,446	60
Unincorporated	Commercial	20	\$3,993,712	\$3,993,712	\$7,987,424	\$1,996,856	
	Residential	373	\$82,044,750	\$41,022,375	\$123,067,125	\$30,766,781	1,022
	Total	393	\$86,038,462	\$45,016,087	\$131,054,549	\$32,763,637	1,022
	Grand Total	418	\$88,633,938	\$46,400,194	\$135,034,132	\$33,758,533	1,085

Source: Sublette FEMA FIRM 1/1/2008 & Hazus-MH MR2, Wyoming CAMA 2021, Wood GIS Analysis

Table 4-22 Wind River Indian Reservation Buildings & Parcels at Risk to 1% Flood Hazard

Improved Parcels	Building Counts	Improved Value	Est. Content Value	Total Exposure	Estimated Loss	Pop.
77	310	\$16,477,270	\$11,199,185	\$27,676,455	\$6,919,114	806

Source: Fremont FEMA NFHL 2/5/2014 & Hazus-MH MR2, Wind River Indian Reservation, Wyoming CAMA 2021, Wood GIS Analysis

NFIP Claims Analysis

Another method of examining the magnitude and severity of flooding in the Region is to examine the damage losses and payments from the National Flood Insurance Program (NFIP). This information is not comprehensive, because it only reflects the communities that participate in the NFIP, but it is a useful overview of flood damages in the region. The information summarized in Table 4-16 below represents the composite of unincorporated and community-specific policies, claims and payments. According to statistics from the National Flood Insurance Program (<http://www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13>) there have been a total of 25 flood insurance claims filed between 1/1/1978 and 05/24/2022 in the region. The total of the payments made on these claims was \$50,582. As of 05/24/2022, there were 71 flood insurance policies in force in the Region for a total coverage of \$20,301,900. More details on National Flood Insurance Program participation can be found within the county annexes.

Repetitive Loss is defined as a NFIP Insured property that has experienced 4 or more paid losses in excess of \$1,000, two paid losses in excess of \$1,000 within any rolling 10-year period, or three or more paid losses that equal or exceed the current value of the insured property. Fremont County has a total of three repetitive loss properties, all of which are located in the Town of Hudson. Sublette and Wind River Reservation have no listed repetitive loss properties at the time of this risk assessment in 2022.

Figure 4-16 NFIP Policy and Insurance Claim Data for Region 5

Location	Policies	Coverage "Insurance in Force"	# of Claims "Closed Paid Losses"	Paid Losses "\$ of closed paid losses"	Repetitive Losses	Substantial Damage claims	# of Policies in A Zones	# of Policies in Non A Zones
Dubois	5	\$969,800	0	0	0	0	4	1
Hudson	4	\$601,300	4	\$32,416	3	0	4	0

Location	Policies	Coverage "Insurance in Force"	# of Claims "Closed Paid Losses"	Paid Losses "\$ of closed paid losses"	Repetitiv e Losses	Substantial Damage claims	# of Policies in A Zones	# of Policies in Non A Zones
Lander	33	\$9,703,400	5	\$3,109	0	0	12	21
Pavillion	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Riverton	0	\$0	1	\$0	0	0	0	0
Fremont	21	\$6,408,400	8	\$15,057			3	18
Shoshoni	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fremont Total	63	\$17,682,900	18	\$50,582	3	0	23	40
Big Piney	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Marbleton	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pinedale	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sublette Total	8	\$2,619,000	7	\$0	0	0	2	6

Source: FEMA Policy and Claim Statistics <http://www.fema.gov/policy-claim-statistics-flood-insurance> and State of Wyoming Department of Homeland Security, NFIP Coordinator as 05/2022

Critical Facilities and Lifelines

To estimate the potential impact of floods on critical facilities, a GIS overlay was performed of the flood hazard layer with critical facility point locations data. Critical facilities at-risk to the 1% annual chance flood in Fremont County and FEMA Lifelines are listed in Table 4-23. Critical facilities at-risk to the 0.2% annual chance flood are shown in Table 4-24.

Replacement values were not available with the data, thus an estimate of potential monetary loss could not be performed. Impacts to any of these facilities could have wide ranging ramifications, in addition to property damage and other cascading impacts.

Table 4-23 Fremont Critical Facilities at Risk to 1% Annual Chance Flood Hazard by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Dubois	-	-	-	-	-	-	6	6
Lander	-	-	-	-	-	-	1	1
Riverton	-	-	-	-	-	-	1	1
Unincorporated	5	1	-	-	-	-	64	70
Total	5	1	0	0	0	0	72	78

Source: Fremont FEMA NFHL 2/5/2014 & Hazus-MH MR2, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

The 1% annual chance of flooding for Fremont shows that the majority of facilities that are critical and at risk to flood damage are within the transportation lifelines with 64 being located in unincorporated areas and 70 total. It should be noted that the majority of these are bridges and have a lower risk of flooding.

Fremont's critical facilities within a 500-year chance of flooding is shown below in Table 4-24 with one Safety and Security critical facility being located in Lander.

Table 4-24 Fremont Critical Facilities at Risk to 0.2% Annual Chance Flood Hazard by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Lander	-	-	-	-	-	1	-	1
Total	0	0	0	0	0	1	0	1

Source: Fremont FEMA NFHL 2/5/2014 & Hazus-MH MR2, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Sublette County has a total of 78 total critical facilities located in the 1% annual chance of flooding area as notated in Table 4-25 below. As noted in Fremont's FEMA 1% critical facility data, the unincorporated areas have the largest amount, with 64 of the 72 transportation facilities being at risk to a 1% annual chance of flooding. The next highest sum of critical facilities at risk of the 1% annual chance of flooding are located in the communication sectors with 5 total being located in unincorporated Sublette County. These can and are bridges that can be and at a lower risk of flooding.

FEMA has not converted Sublette County into their DFIRM or NFHL products at this time. A digitized version of the effective maps provided by the County were used for the plan's mapping and analysis. Sublette County's initial effective maps were Flood Hazard Boundary Maps with a date of 11/15/1977. FEMA then reviewed and converted the flood study to Flood Insurance Rate Map (FIRM) with an updated effective date of 1/1/2008. Neither flood study produced 0.2% or 500-year chance of flooding for Sublette County.

Table 4-25 Sublette Critical Facilities at Risk to 1% Flood Hazard (FEMA & Hazus) by Jurisdiction and FEMA Lifeline

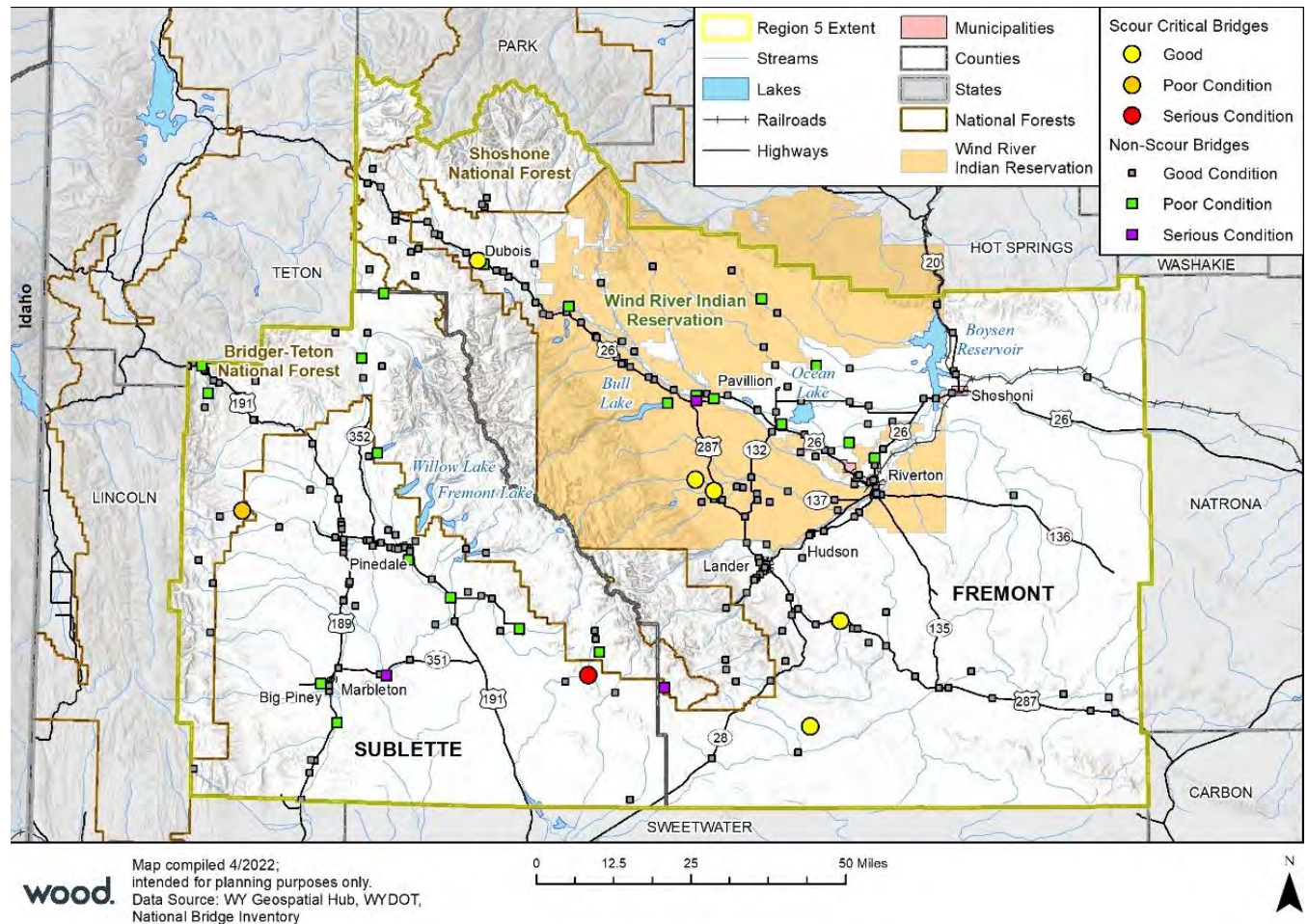
Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Big Piney	-	-	-	-	-	-	-	0
Marbleton	-	-	-	-	-	-	-	0
Pinedale	4	-	-	-	-	-	1	5
Unincorporated	-	-	-	-	-	-	42	42
Total	4	0	0	0	0	0	43	47

Source: Sublette FEMA FIRM 1/1/2008, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Transportation routes could be cut off due to floodwaters, isolating portions of the planning area. These impacts may last after the floodwater recedes as flash floods commonly cause extensive damage to roadway infrastructure.

Region 5 does have a number of bridges of concern, including scour critical (a bridge with a foundation element determined to be unstable for the observed or evaluated scour condition), structurally deficient (when key components like the superstructure are inspected and rated 'poor' or worse by a bridge engineer), and functionally obsolete (when design components are outdated) facilities. Figure 4-17 shows the locations and condition of bridges throughout Region 5.

Figure 4-17 Region 5 Bridges



Economy

Flooding can have major negative impacts on the local and regional economy, including indirect losses such as business interruption, lost wages, reduced tourism and visitation, and other downtime costs. Flood events can cut off customer access to a business as well as close a business for repairs or permanently. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures. Additionally, flooding can impact the economy through the direct damages and losses to property and costs to recover, as summarized in the property section above.

Environmental and Cultural Resources

Natural resources are generally resistant to flooding and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in or in areas after periods of previous disasters

such as drought and fire, flooding can impact the environment in negative ways. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought. Areas recently suffering from wildfire damage may erode because of flooding, which can permanently alter an ecological system. Fish can wash into roads or over dikes into flooded fields, with no possibility of escape.

Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Tourism and outdoor recreation are an important part of the Region's economy. If part of the planning area were damaged by flooding, tourism and outdoor recreation could potentially suffer.

Development Trends

As the communities of Region 5 develop and expand in the future, mapping of the floodplain and managing growth within it will be important for reducing future flood risk. For NFIP participating communities, floodplain management practices implemented through local floodplain management ordinances should mitigate the flood risk to new development in floodplains. Lack of adequate flood hazard mapping can make it a challenge to assess risk to future development, particularly in Sublette County, where some of the flood risks are not digitally mapped.

For NFIP participating communities, floodplain management practices implemented through local floodplain management ordinances should mitigate the flood risk to new development in floodplains. The lack of comprehensive flood hazard mapping in Fremont County makes floodplain management challenging in some areas of the County. The Reservation does not have floodplain mapping and does not participate in the NFIP, thus future development could be at risk, though significant growth and development within the Reservation is not anticipated.

Risk Summary and Overall Significance by Jurisdiction

Overall, flooding presents a **medium to high risk** for the counties, tribes and communities of Region 5. Somewhere in the region floods every 2-7 years. Flooding has damaged homes, infrastructure (roads and bridges), and caused agricultural losses in the region in the past. Ice jam flooding has caused problems. Flood risk varies by jurisdiction and this risk is detailed further in the county and reservation annexes.

Table 4-26 Flood Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Significant	Highly Likely	Limited	High
Sublette	Limited	Likely	Limited	Medium
Wind River Reservation	Significant	Highly Likely	Limited	High

4.2.6 Earthquake

Hazard/Problem Description

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called

“seismic waves” are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes can last from a few seconds to over five minutes; they may also occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties generally result from falling objects and debris, because the shocks shake, damage, or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer, and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides, or releases of hazardous material, compounding their disastrous effects.

Earthquakes tend to reoccur along faults, which are zones of weakness in the crust. Even if a fault zone has recently experienced an earthquake, there is no guarantee that all the stress has been relieved. Another earthquake could still occur. Small, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes but, because of their distance and depth, they may result in only moderate shaking in an area.

Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, communication, and transportation lines. Other damaging effects of earthquakes include surface rupture, fissuring, ground settlement, and permanent horizontal and vertical shifting of the ground. Secondary impacts can include landslides, seiches, liquefaction, fires, and dam failure. The combination of widespread primary and secondary effects from large earthquakes makes this hazard potentially devastating.

Part of what makes earthquakes so destructive is that they generally occur without warning. The main shock of an earthquake can usually be measured in seconds, and rarely lasts for more than a minute. Aftershocks can occur within the days, weeks, and even months following a major earthquake.

By studying the geologic characteristics of faults, geoscientists can often determine when the fault last moved and estimate the magnitude of the earthquake that produced the last movement. Because the occurrence of earthquakes is relatively infrequent in Fremont County and the historical earthquake record is short, accurate estimations of magnitude, timing, or location of future dangerous earthquakes in the County are difficult to estimate.

Liquefaction

During an earthquake, near surface (within 30 feet), relatively young (less than 10,000 years old), water-saturated sands and silts may act as a viscous fluid. This event is known as liquefaction (quicksand is a result of liquefaction). Liquefaction occurs when water-saturated materials are exposed to seismic waves. These seismic waves may compact the material (i.e. silts and sands), increasing the interior pore water pressure within the material mass.

When the pore pressure rises to about the pressure of the weight of the overlying materials, liquefaction occurs. If the liquefaction occurs near the surface, the soil bearing strength for buildings, roads, and other structures may be lost. Buildings can tip on their side, or in some cases sink. Roads can shift and become unstable to drive on. If the liquefied zone is buried beneath more competent material, cracks may form in the overlying material, and the water and sand from the liquefied zone can eject through the cracks as slurry.

Geographical Area Affected

Yellowstone National Park is within close proximity to Region 5 and is one of the more seismically active areas in the United States. Most Wyoming earthquakes outside of Yellowstone National Park occur as a

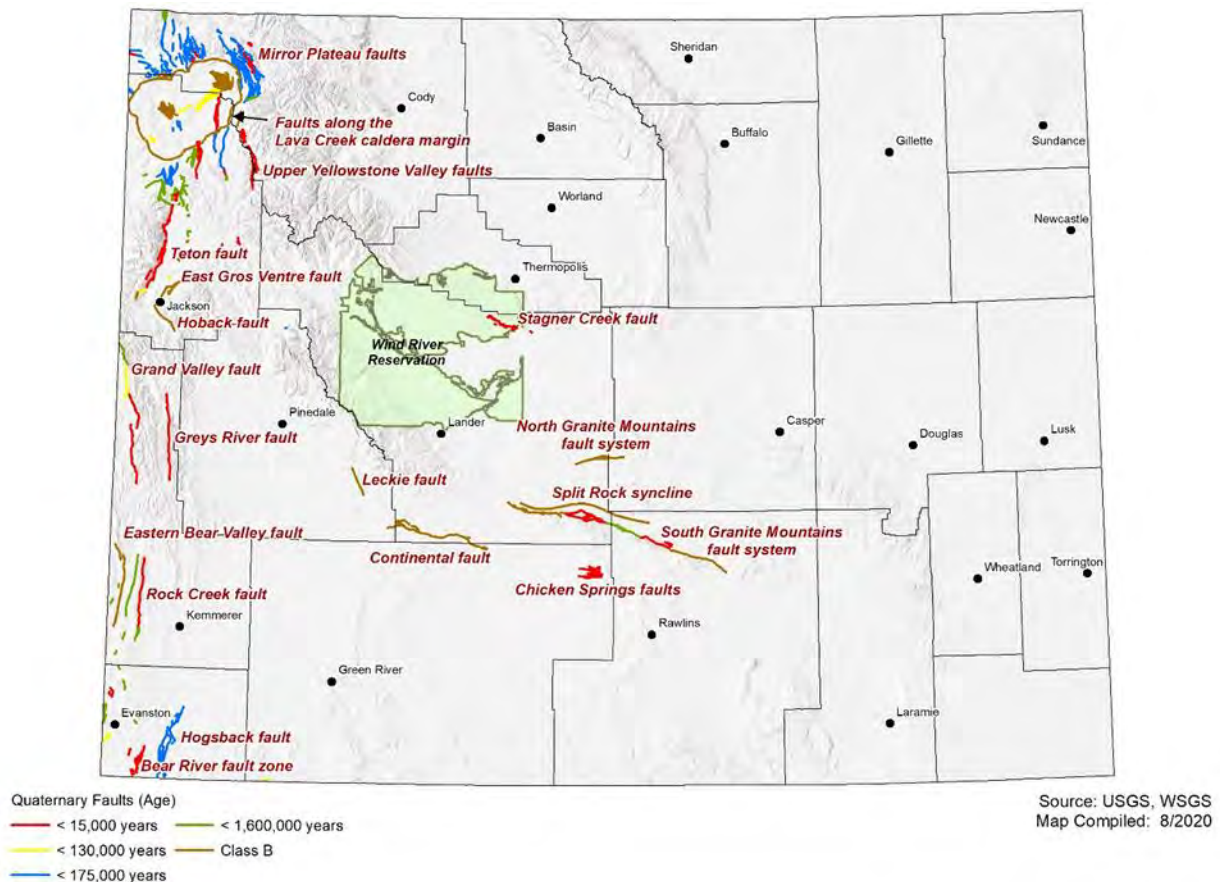
result of movement on faults. If the fault has moved within the Quaternary geological period, or last 1.6 million years, the fault is considered to be active. Active faults can be exposed at the surface or deeply buried with no significant surface expression. Historically, no earthquakes in Wyoming have been associated with exposed active faults. The exposed active faults, however, have the potential to generate the largest earthquakes. As a result, it is necessary to understand both exposed and buried active faults in order to generate a realistic seismological characterization of the state.

According to the Wyoming State Geological Survey, there are approximately 80 Quaternary faults mapped in Wyoming, with 26 considered active. Most of the exposed active faults are outside of Region 5. The Teton fault, Star Valley fault, Greys River fault, Rock Creek fault, and the Bear River fault system in western Wyoming are capable of generating magnitude 7.0 to 7.5 earthquakes and are considered to be overdue for reactivation. In central Wyoming, the Stagner Creek fault system near Boysen Reservoir and the South Granite Mountain fault system near Jeffrey City, are both considered potentially active and capable of generating magnitude 6.5 to 6.75 earthquakes.

A dynamic magma chamber beneath Yellowstone National Park, combined with regional tectonic forces, results in significant seismic activity. Many of the earthquakes are associated with movement of hydrothermal fluids in the subsurface. Some deeper earthquakes may be related to fluids within or around the magma chamber. Earthquakes which may be related to active faults also occur in the park. Yellowstone is a super-volcano, and it has explosively erupted 0.64 million, 1.3 million, and 2.1 million years ago. The explosive eruptions led to the formation of three giant calderas, the collapse of which led to the formation of faults. In addition, after major eruptions, resurgent domes formed within the calderas. The doming process led to the formation of other faults. As a result, many of the faults in Yellowstone are not considered major threats.

Historically, Wyoming's earthquakes are tied to faults that are buried. Buried faults that have never broken the surface are generally considered to be capable of generating up to magnitude 6.5 earthquakes. Since the distribution of the buried faults is not well known, it is assumed that earthquakes up to magnitude 6.5 can occur anywhere in the state. (State Hazard Mitigation Plan 2021).

Figure 4-18 Exposed Known or Suspected Active Faults in Wyoming



Source: Wyoming Geological Survey, Figure by WSP

The South Granite Mountain fault system is located in southeastern Fremont County and northwestern Carbon County. The fault system is composed of several west-northwest-trending faults that border the northern flanks of the Seminole Mountains, Ferris Mountain, Green Mountain, and Crooks Mountain. Geomatrix Corporation did an analysis on segments of the fault and concluded segments were capable of generating a maximum credible earthquake of magnitude 6.5 – 6.75.

The Stagner Creek fault system is an east-west trending system located near Boysen Reservoir on the south flank of the Owl Creek uplift in Fremont County and on the Wind River Reservation. Geomatrix Corporation determined that the maximum length of the fault is 24 miles (38 km), with Quaternary-age displacement found along a 17-mile (27 km) segment of the fault between Mexican Pass and Tough Creek. The maximum credible earthquake for this fault system was determined to be a magnitude 6.75 event.

The Cedar Ridge/Dry Fork fault system is present in northeastern Fremont County and northwestern Natrona County. The 35-mile-long Cedar Ridge fault comprises the western portion of the fault system, and the 15-mile long Dry Fork fault makes up the eastern portion. After various assessments, Geomatrix concluded that it is not possible to conduct a reliable deterministic analysis on the fault system; however, general estimates can be made. Although there is no compelling reason to believe that the Dry Fork fault system is active, if it did activate as an isolated system, it could potentially generate a magnitude 6.7 earthquake.

Figure 4-19 shows areas in Wyoming that could experience liquefaction during an intense earthquake. Areas shown have sands and coarse silts that are less than 10,000 years in age and are within 30 feet of the surface. Portions of the Region have the necessary components to experience liquefaction including along the Big and Little Wind rivers in Fremont County and the Reservation and Sublette Flats in Sublette County.

Figure 4-19 Wyoming Liquefaction Coverage



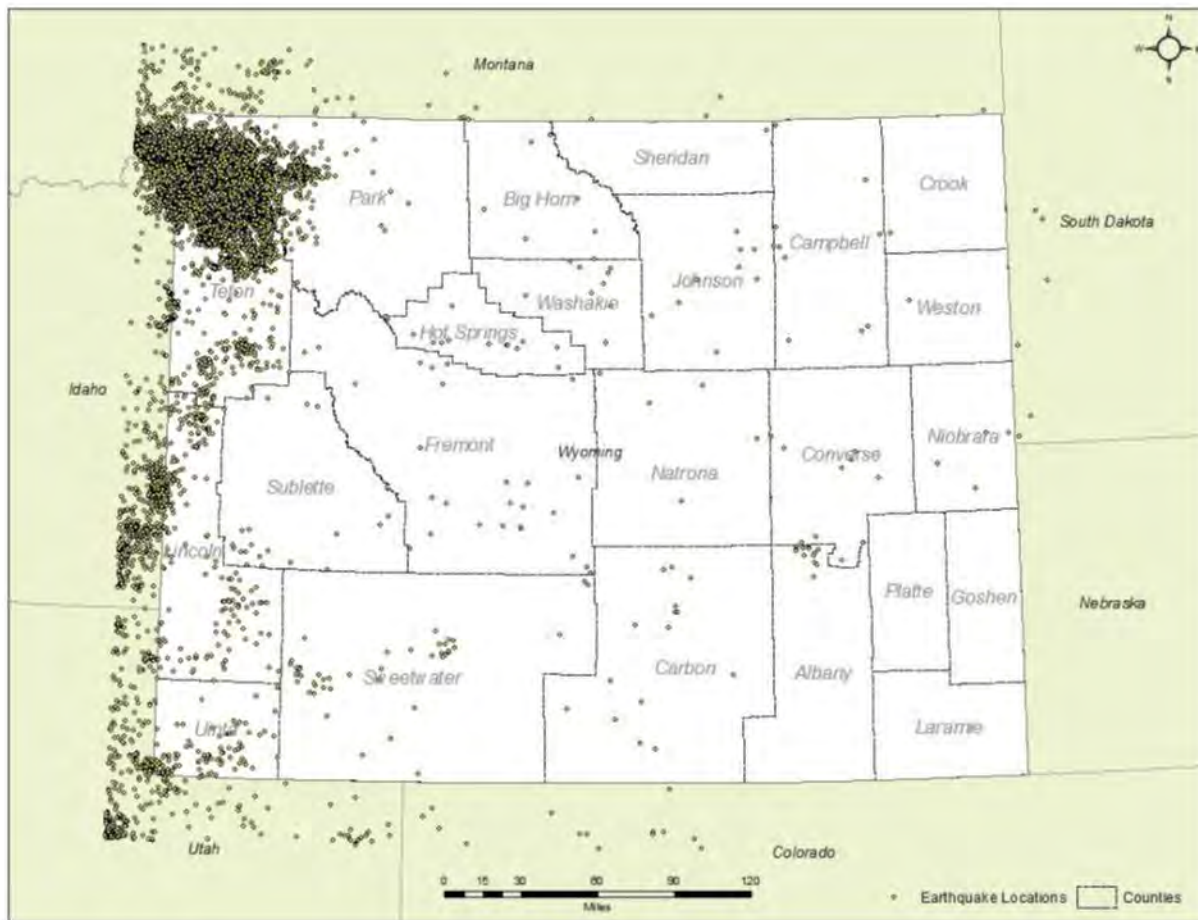
Source: Wyoming Geological Survey

Past Occurrences

Prior to the 1950s, most earthquakes were detected and located by personal reports. After the Hebgen Lake earthquake in 1959 near Yellowstone Park, monitoring in Wyoming started to improve and earthquakes were more commonly located by seismometers.

Since 1871, the state has logged some 47,000 earthquakes, with the majority of the events taking place in the western third of the state (see Figure 4-20) where the majority of the active, or Quaternary Period, faults are identified.

Figure 4-20 Wyoming Historic Earthquake Occurrences Statewide 1963- 2010



Source: Wyoming Geological Survey - Wyoming Earthquake Hazard and Risk Analysis: HAZUS-MH Loss Estimations for 16 Earthquake Scenarios Report

Historically, earthquakes have occurred in every county in Wyoming. The first was reported in Yellowstone National Park in 1871. Data on instrumentally recorded earthquakes is available from the USGS Earthquake Hazards Program dating back to 1973. Five magnitude 4.8 and greater earthquakes have been recorded in the Region since 1973, with four of these events taking place in Fremont County. These earthquakes are noted in the tables below and discussed in further detail below by county.

Table 4-27 Earthquakes Greater than 2.5 in Region 5: 1973-April 2022

County	Magnitude 2.5-2.9	3-3.9	4.0-5.8	Total
Sublette	8	8	3	19
Fremont	14	20	6	40
Total	22	28	9	59

Source: Analysis of data from USGS Earthquake Hazards Program

Table 4-28 Ten Highest Magnitude* Earthquakes in Region 5: 1973-April 2022

County	Magnitude	Date
Fremont	5	1984-11-03
Sublette	4.8	2016-08-27
Fremont	4.8	2013-09-21
Fremont	4.8	1975-03-25
Fremont	4.8	1973-04-22
Sublette	4.3	2001-09-27
Fremont	4.3	1985-08-16
Sublette	4	2007-10-31
Fremont	4	1992-10-10
Sublette	3.9	2011-04-01

*Based on instrumentally recorded earthquakes. Source: USGS Earthquake Hazards Program

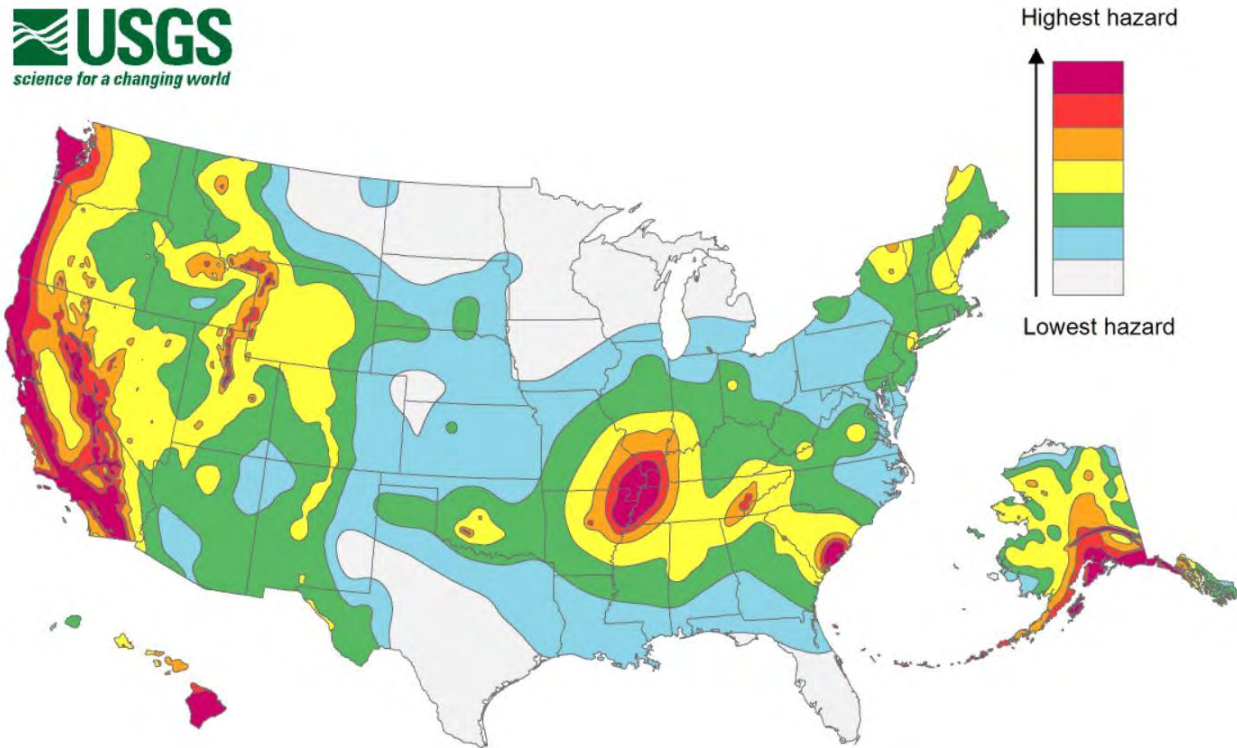
The largest earthquake in the region was a M5.0 that occurred 10 km west of Atlantic City in 1984. This earthquake had a reported modified Mercalli intensity of VII Very Strong. The most recent significant earthquake since the last plan update occurred in Fremont County September 21, 2013. The epicenter of the M4.8 earthquake was nine miles west of Ft. Washakie, Wyoming. The USGS event 'Did You Feel It?' web page shows 217 people went online to say they felt the quake, with a maximum intensity IV reported (Wyoming Hazard Mitigation Plan 2021).

Frequency/Likelihood of Future Occurrence

With a total of 37 recorded earthquakes with a magnitude greater than 3.0 in the last 48 years, the Region could expect a 77% chance of experiencing an earthquake of similar magnitude each year; or a likely occurrence rating. However also based on past occurrences, the earthquakes are likely to cause little to no damage. To determine the likelihood of damaging earthquakes the U.S. Geological Survey (USGS) publishes probabilistic acceleration maps for 500-, 1000-, and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a 10% probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100% probability of exceedance in 500 years. The nationwide 2,500-year (2% probability of exceedance in 50 years) map from the USGS is shown in the figure below. The International Building Code uses a 2,500-year map as the basis for building design. The maps reflect current perceptions on seismicity in Wyoming based on available science. In many areas of Wyoming, ground accelerations shown on the USGS maps can be increased further due to local soil conditions. For example, if fairly soft, saturated sediments are present at the surface, and seismic waves are passed through them, surface ground accelerations will usually be greater than would be experienced if only bedrock was present. In this case, the ground accelerations shown on the USGS maps would underestimate the local hazard, as they are based upon accelerations that would be expected if firm soil or rock were present at the surface.

As the historic record is limited, it is nearly impossible to determine when a 2,500-year event last occurred in the county. Because of the uncertainty involved and based upon the fact that the International Building Code utilizes 2,500-year events for building design, it is suggested that the 2,500-year probabilistic maps be used for regional and county analyses. This conservative approach is in the interest of public safety.

Figure 4-21 2500-year probabilistic acceleration map (2% probability of exceedance in 50 years)



Source: USGS

Changing Future Conditions

Changes in future conditions in Wyoming are not expected to directly affect earthquake frequency or intensity.

Potential Magnitude (Extent)

The amount of energy released during an earthquake is usually expressed as a Richter magnitude and is measured directly from the earthquake as recorded on seismographs. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface as felt by humans or resulting damage to structures and defined in the Modified Mercalli scale (see Table 4-29 and Table 4-30). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-29 Modified Mercalli Intensity (MMI) Scale

MMI	Shaking	Felt Intensity
I	Not Felt	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Weak	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Weak	Felt noticeably indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibrations similar to the passing of a truck.

MMI	Shaking	Felt Intensity
IV	Light	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle; walls make cracking sound. Sensation like heavy truck striking a building. Standing cars rocked noticeably.
V	Moderate	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned. Pendulum clocks may stop.
VI	Strong	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage is slight in specially designed structures, considerable in ordinary substantial buildings with partial collapse, great in poorly built structures. Chimneys, factory stacks, columns, monuments, walls fall. Heavy furniture is overturned.
IX	Violent	Damage is considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked and rails are bent. Considerable landslides occur on steep slopes.
XI	Extreme	Few, if any, masonry structures remain standing. Rails are bent and bridges destroyed. Broad fissures appear in the ground. Underground pipelines are rendered completely out of service. Earth slumps and land slips in soft ground.
XII	Extreme	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: USGS. <http://earthquake.usgs.gov/learn/topics/mercalli.php>

Table 4-30 Modified Mercalli Intensity (MMI) Scale and Peak Ground Acceleration

MMI	Acceleration (%g) (PGA)
I	<0.17
II	0.17 – 1.4
III	0.17 – 1.4
IV	1.4 – 3.9
V	3.9 – 9.2
VI	9.2 – 18
VII	18 – 34
VIII	34 – 65
IX	65 – 124
X	>124
XI	>124
XII	>124

Source: Modified Mercalli Intensity and peak ground acceleration (PGA) (Wald, et al 1999).

Limited damages have been documented in the Region from historic earthquakes. Because of the limited historic record, however, it is possible to underestimate the seismic hazard in the Region if historic earthquakes are used as the sole basis for analysis. Earthquake and ground motion probability maps give a more reasonable estimate of damage potential in areas with or without exposed active faults at the surface. Current earthquake probability maps that are used in the newest building codes suggest a scenario that would result in moderate damage to buildings and their contents, with damage increasing from the northwest to the east.

Vulnerability Assessment

During the 2020-2021 update process for the Wyoming State Hazard Mitigation Plan, earthquake vulnerability data was generated for each county in the state using a Level 1 HAZUS-MH analysis. HAZUS (Hazards U.S.) is a nationally standardized, GIS-based, risk assessment and loss estimation computer program that was originally designed in 1997 to provide the user with an estimate of the type, extent, and cost of damages and losses that may occur during and following an earthquake. It was developed for the FEMA by the National Institute of Building Sciences (NIBS). There have been a number of versions of HAZUS generated by FEMA, with HAZUS-MH (HAZUS - Multi-Hazard) being the most recent release.

Once the location and size of a hypothetical earthquake are identified, HAZUS-MH estimates the intensity of the ground shaking, the number of buildings damaged, the number of casualties, the damage to transportation systems and utilities, the number of people displaced from their homes, and the estimated cost of repair and clean up. Additional information provided includes anticipated households displaced or seeking temporary shelter, electrical outages anticipated, number of households without potable water, debris generated by the scenario and economic losses resulting from three categories: buildings, transportation, and utilities.

People

The entire population of Region 5 is potentially exposed to direct and indirect impacts from earthquakes. The degree of exposure is dependent on many factors, including the age and construction type of the structures people live in, the soil types their homes are constructed on, their proximity to fault location, etc. Whether impacted directly or indirectly, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could keep people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself.

Three population groups are particularly vulnerable to earthquake hazards:

- **Linguistically Isolated Populations**—Problems arise when there is an urgent need to inform non-English speaking residents of an earthquake event. They are vulnerable because of difficulties in understanding hazard-related information from predominantly English-speaking media and government agencies.
- **Population below Poverty Level**—Families and individuals with incomes below the poverty level may lack the financial resources to improve their homes to prevent or mitigate earthquake damage. Poorer residents are also less likely to have insurance to compensate for losses in earthquakes.
- **Population over 65 Years Old**—This population group is vulnerable because they are more likely to need special medical attention, which may not be available due to isolation caused by earthquakes. Elderly residents also have more difficulty leaving their homes during earthquake events and could be stranded in dangerous situations

Casualty impacts on persons in the planning area were estimated for the 2,500-Year Probabilistic Earthquake. Casualty levels as defined by Hazus-MH are described as follows:

- Level 1: Injuries will require medical attention, but hospitalization is not needed
- Level 2: Injuries will require hospitalization but are not considered life-threatening
- Level 3: Injuries will require hospitalization and can become life-threatening if not promptly treated
- Level 4: Victims are killed by the earthquake

These impacts are summarized by County in Table 4-31 below.

Table 4-31 Estimated 2500-Year Probabilistic Earthquake Impact on Persons and Households

Jurisdiction	Casualty Level 1	Casualty Level 2	Casualty Level 3	Casualty Level 4
Fremont	67	10	1	2
Sublette	71	15	2	4

Source: Hazus-MH 4.2

Property

All structures in the planning area are susceptible to earthquake impacts to varying degrees. Hazus 4.2.3 uses building inventory based on 2018 RS Means Valuation Updates for general building stock and values.

There are two methods of ranking counties to determine where earthquake impacts may be the greatest. Either the loss ratios or total damage figures can be used (Table 4-32). The loss ratio is determined by dividing the sum of the structural and non-structural damage by the total building value for the county. The loss ratio is a better measure of impact for a county as it gives an indication of the percent of damage to buildings. The total damage figure by itself does not reflect the percentage of building damage. If a county has a number of valuable buildings, small damage to a number of valuable buildings may result in a higher total damage figure than what may be found in a county with fewer, less expensive buildings with a higher percentage of damage. The probabilistic loss estimates may significantly over-estimate actual losses sustained from an individual earthquake. The data shows aggregated loss potential, rather than potential losses for a specific event. Fremont County can experience the highest potential loss due to building exposure and closer proximity to seismic sources, whereas Sublette County can experience a much higher loss ratio.

Table 4-32 Region 5 2,500-Year Probabilistic Scenario Loss Estimates

Jurisdiction	Total Loss (\$M)	Loss Ratio
Fremont	\$137	2.2%
Sublette	\$113	4.8%

Source: HAZUS-MH Global Summary Report, Wood analysis

Critical Facilities and Lifelines

All critical facilities and infrastructure in the planning area are exposed to the earthquake hazard. Hazardous Materials (HAZMAT) releases can occur during an earthquake from fixed facilities or transportation-related incidents. Transportation corridors can be disrupted during an earthquake, leading to the release of materials to the surrounding environment. Facilities holding HAZMAT are of particular concern because of possible isolation of neighborhoods surrounding them. During an earthquake, structures storing these materials could rupture and leak into the surrounding area or an adjacent waterway, having a disastrous effect on the environment.

Damage impacts to transportation corridors and communications lines could affect first responders' ability to effectively respond in the aftermath of an earthquake. Damage to government facilities/personnel in incident area may require temporary relocation of some operations. Regulatory waivers may be needed locally. The public may question local government's ability to respond and recover if planning, response, and recovery are not timely and effective. A significant earthquake may require disaster declarations and aid programs. These needs may impact funding or administrative resources for other regular operations or may necessitate changes to existing operating procedures.

Another critical facility vulnerability that is more unique to Region 5 is the potentially higher seismic risk of Boysen Dam located in Fremont County. Should this Bureau of Reclamation dam structure fail, impacts to

all counties in the downstream regions through flooding on the Big Horn or Shoshone Rivers would result in minor to significant damage to the counties and towns along those waterways.

HAZUS-MH classifies the vulnerability of critical facilities to earthquake damage in two categories: at least moderate damage or complete damage. The analysis did not indicate any damages in these categories to specific facilities. Damage to the transportation system and utility lifelines is possible; specific loss numbers were not available at county levels from the Hazus analysis done for the Wyoming State Hazard Mitigation Plan.

Economy

Impacts to the economy from an earthquake can be direct, in the form of direct damages and losses to buildings and infrastructure, and indirect, often in the form of lost wages and business income, relocation costs, and other costs of recovery. Capital stock and income losses by County in Region 5 are shown below in Table 4-33.

Table 4-33 Region 5 Economic Impacts, 2500-Year Probabilistic Earthquake Scenario

County	Capital Stock Losses (Thousands of Dollars)					Income Losses (Thousands of Dollars)				Total Loss
	Structural	Non-Structural	Contents	Inventory	Loss Ratio (%)	Relocation	Capital-Related	Wages	Rental	
Fremont	\$14,414	\$66,661	\$32,169	\$842	2.16	\$10,178	\$3,471	\$4,705	\$4,345	\$136,786
Sublette	\$16,085	\$54,826	\$21,552	\$556	4.81	\$9,033	\$3,231	\$3,717	\$4,150	\$113,150

Environment and Cultural Resources

Secondary hazards associated with earthquakes will likely have some of the most damaging effects on the environment. Earthquake-induced landslides can significantly impact surrounding habitat. Streams can be rerouted or blocked entirely as occurred in the Hebgen Lake event in Montana, after an earthquake. This can change the water quality, possibly damaging habitat and feeding areas. There is a possibility of streams fed by groundwater drying up because of changes in underlying geology. Historic building stock is commonly made of unreinforced masonry which is vulnerable to damage from earthquakes.

Liquefaction Vulnerability

There have been little, if any, reported damages from liquefaction in Wyoming. Given that ground motions associated with Intensity VIII or larger are usually needed to trigger liquefaction, and that only small areas of the Region would experience that level of shaking during the 2% event (2% probability of exceedance in 50 years), liquefaction would be a rare occurrence in the Region

Future Development

Future development in the Region is not anticipated to extensively change vulnerability to earthquake significantly.

Summary

In summary, within Region 5, Fremont County and Wind River Reservation have risk due to the close proximity of potentially active faults; the proximity of Sublette County to the higher risk seismic zones in western Wyoming also makes it potentially vulnerable. It is estimated that if a worst-case event occurred in Fremont County, \$137 million in combined capital stock and income losses could occur. In Sublette County, an estimated \$113 million in combined capital stock and income losses could occur. Sublette County could experience an interruption in goods and services if western Wyoming experiences a significant earthquake

that affects the transportation network. Though the probability is low, Wyoming State Geological Survey (WSGS) studies indicate the possibility of a 6.5 magnitude could occur anywhere in the state.

Table 4-34 Earthquake Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Significant	Occasional	Critical	Medium
Sublette	Limited	Occasional	Critical	Medium
Wind River Reservation	Significant	Occasional	Critical	Medium

4.2.7 Expansive Soils

Hazard/Problem Description

Soils and swelling bedrock contain clay which causes the material to increase in volume when exposed to moisture and shrink as it dries. They are also commonly known as expansive, shrinking and swelling, bentonitic, heaving, or unstable soils and bedrock. In general, the term refers to both soil and bedrock contents although the occurrence of the two materials may occur concurrently or separately. The difference between the materials is that swelling soil contains clay, while swelling bedrock contains claystone. (Source: Colorado Geological Survey Department of Natural Resources, *A Guide to Swelling Soils for Colorado Homebuyers and Homeowners*. (Denver, Colorado.) 1997. p 15-16.)

The clay materials in swelling soils are capable of absorbing large quantities of water and expanding 10 percent or more as the clay becomes wet. The force of expansion is capable of exerting pressures of 15,000 pounds per square foot or greater on foundations, slabs, and other confining structures. (Ibid., p 17.) The amount of swelling (or potential volume of expansion) is linked to five main factors: the type of mineral content, the concentration of swelling clay, the density of the materials, moisture changes in the environment, and the restraining pressure exerted by materials on top of the swelling soil. Each of these factors impact how much swelling a particular area will experience, but may be modified, for better or worse, by development actions in the area.

- **Low**—this soils class includes sands and silts with relatively low amounts of clay minerals. Sandy clays may also have low expansion potential, if the clay is kaolinite. Kaolinite is a common clay mineral.
- **Moderate**—this class includes silty clay and clay textured soils, if the clay is kaolinite, and also includes heavy silts, light sandy clays, and silty clays with mixed clay minerals.
- **High**—this class includes clays and clay with mixed montmorillonite, a clay mineral which expands and contracts more than kaolinite.

Geographical Area Affected

Expansive soils occur throughout the Region. Figure 4-22 illustrates possible expansive soils locations in Wyoming.

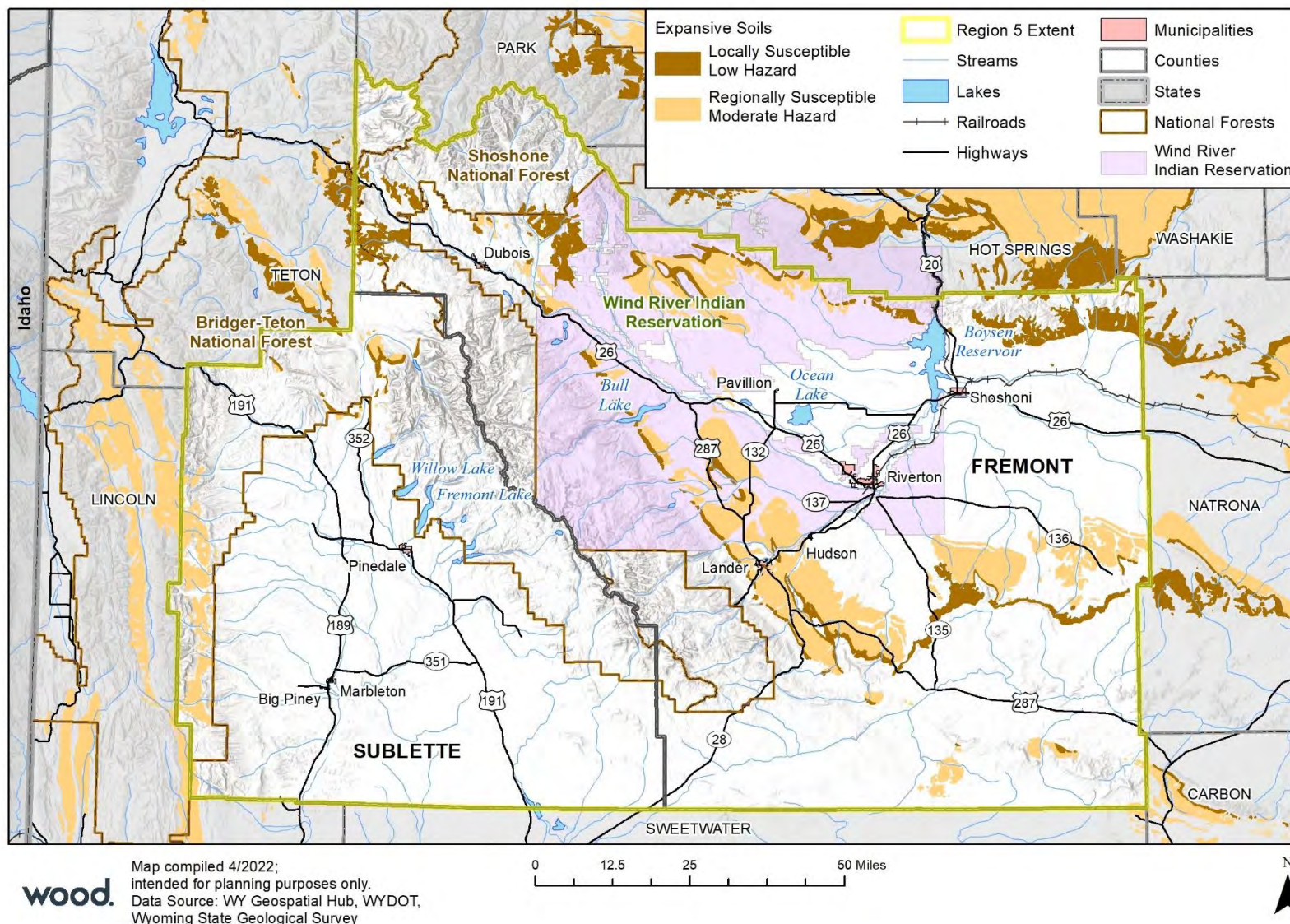
The HMPCs weighed in on the risk from expansive soils, based on their experience. The Fremont County HMPC stated that there were no known issues of expansive soils in the County, but that they were aware of areas where expansive soils occur, including north of Riverton. They noted that the County Planning Department uses NRCS soils maps to identify potential problem soils.

The Sublette County HMPC noted that there were no known expansive soils issues in the county.

The Wind River Reservation HMPC noted that Beaver Creek and the eastern end of the reservoir were problem areas for expansive soils.

Based on the figures below, expansive soils are estimated to affect a limited portion of the planning area in Sublette County but more extensive in Fremont County; mapping is based on Wyoming State Geological Survey (WSGS) data that was updated in 2019.

Figure 4-22 Expansive Soil Potential in Wyoming



Past Occurrences

Very little data exists on expansive soil problems and damages in Wyoming. Studies on the issue have not been performed and no database exists to catalog occurrences. Damages due to expansive soils such as foundation cracks, parking lot/sidewalk cracks, etc. do occur but are generally handled by individual property owners. Other damages to supply lines, roads, railways, bridges, and power lines typically occur over time and are not attributed to or reported as an event.

Frequency/Likelihood of Occurrence

Historical data on expansive soils issues was not readily available, making frequency difficult to extrapolate. Expansive soils will most likely be an occasional problem for the jurisdictions in Region 5.

Changing Future Conditions

Many soils and rocks have the potential to swell based on a combination of mineralogy and water content. The actual swelling will be caused by a change in the environment (e.g. water content, stress, chemistry, or temperature) in which the material exists. Since the 1950s, precipitation and duration of snowpack have both decreased while rising temperatures have increased the rate of water evaporating into the air, creating drier soil conditions in Wyoming (EPA 2016). More extremes in future conditions, such as drastic wet/dry weather patterns, could potentially exacerbate swelling soil issues in the future.

Potential Magnitude (Extent)

Expansive soils vary by the potential for linear extensibility. The volume change measured with linear extensibility is reported as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change. The higher the shrink-swell potential of the soil, the greater the damage that may occur to buildings or infrastructure built in those areas. Expansive soils with linear extensibility potential of less than 3 percent have a low shrink-swell potential, 3-6 percent is moderate, and 6-9 percent is high, and above 9 percent is very high. It is estimated that expansive soils in the Region can span the spectrum of linear extensibility, mostly in the low to moderate range, and will vary based on site specifics.

The potential magnitude of expansive soils events and damages is estimated to be negligible for the counties in the Region. No impacts related to expansive soils have been reported thus far. Because damages from expansive soils tend to happen over an extended period of time, it is difficult to estimate the potential severity of a problem. Many deposits of expansive soils do not inflict damage over large areas. Instead, these deposits can often create localized damage to individual structures and supply lines, such as roads, railways, bridges and power lines.

Vulnerability Assessment

Vulnerability to expansive soils comes from exposure to the hazard. Geologic formations with suspected expansive soils have been digitized, allowing a GIS overlay analysis with county assessor data to be conducted in order to better understand and quantify the vulnerability in Region 5. This data represents an enhancement to this plan in 2022, as previously there was limited GIS data for expansive soils. These results represent exposure and the potential for damage, not a true loss estimate. Damage from these soils will typically be isolated events, which will cause damage to a small number of buildings or road segments over time and does not cause complete damage or structure loss.

People

According to GIS analysis of the number of residential structures exposed to expansive soils and the average household size for each county, there are approximately 5,692 people residing in areas of moderate and low expansive soils throughout Region 5. However, there have been no reported injuries or deaths resulting from expansive soils in Region 5, and direct impacts on people are likely to be very minimal.

Property

As identified in the hazard profile and noted above, extensive areas of the planning region, specifically in Fremont County and areas within the Wind River Reservation, are characterized to some extent by swelling soils. Older construction may not be resistant to the swelling soil conditions and, therefore, may experience expensive and potentially extensive damages. This includes heaving sidewalks, structural damage to walls and basements, the need to replace windows and doors, or dangers and damages caused by ruptured pipelines. Newer construction may have included mitigation techniques to avoid most damage from the hazard, but the dangers continue if mitigation actions are not supported by homeowners. For example, the maintenance of grading away from foundations and the use of appropriate landscaping near structures must be continued to prevent an overabundance of water in vulnerable soils near structures. While continued public education efforts may help increase compliance for landscaping and interior finishing mitigation actions, physical reconstruction of foundations is probably not feasible in all but the most heavily impacted of existing development. Therefore, damages may be expected into the future for existing structures.

The results of this analysis are shown in Table 4-35 below. In total throughout Region 5, there is more than \$251 million in structure improved value exposed to moderate expansive soils across the Region, with the greatest amount in unincorporated Fremont County. There was not available data for the Wind River Reservation to conduct the parcel analysis.

Table 4-35 Parcels at Risk to Low and Moderate Expansive Soils by Jurisdiction

County	Jurisdiction	Improved Parcels	Improved Value	Est. Content Value	Total Exposure
Moderate Risk					
Fremont	Lander	384	\$84,376,213	\$47,346,893	\$131,723,106
	Unincorporated	986	\$167,166,289	\$87,494,987	\$254,661,276
	Total	1,370	\$251,542,502	\$134,841,879	\$386,384,381
Sublette	Unincorporated	6	\$137,102	\$68,551	\$205,653
	Total	6	\$137,102	\$68,551	\$205,653
Grand Total		1,376	\$251,679,604	\$134,910,430	\$386,590,034
Low risk					
Fremont	Unincorporated	986	\$167,166,289	\$87,494,987	\$254,661,276
	Total	986	\$167,166,289	\$87,494,987	\$254,661,276
Sublette	Unincorporated	2	\$572,127	\$286,064	\$858,191
	Total	2	\$572,127	\$286,064	\$858,191
Grand Total		988	\$167,738,416	\$87,781,050	\$255,519,466

Source: Wyoming State Geological Survey, Wyoming CAMA 2021, Wood GIS Analysis

Critical Facilities and Lifelines

Existing critical facilities impacted by expansive soil hazards are of particular concern, as the damages caused to these structures may impact the ability of the planning area to provide critical services to the population. Table 4-36 includes the results of a GIS overlay of critical facilities on the expansive soils data. The unincorporated areas of Region 5 have the most critical facilities at risk and a majority of those are communication and energy FEMA lifelines. This analysis does not take into account site-specific mitigation measures that may be in place.

Table 4-36 Critical Facilities at Risk to Low and Moderate Expansive Soils by Jurisdiction

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Moderate Risk									
Fremont	Lander	-	-	-	-	2	4	-	6
	Unincorporated	32	2	-	1	-	4	11	50
	Total	32	2	0	1	2	8	11	56
Sublette	Unincorporated	7	2	-	-	-	-	1	10
	Total	7	2	0	0	0	0	1	10
Wind River Reservation	Total	17	2	-	-	-	1	3	23
Grand Total		56	6	0	1	2	9	15	112
Low Risk									
Fremont	Unincorporated	-	-	-	-	-	-	1	1
	Total	0	0	0	0	0	0	1	1
Wind River Reservation	Total	1	-	-	-	-	-	1	2
Grand Total		1	0	0	0	0	0	2	3

Source: Wyoming State Geological Survey, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Economy

The economic cost of this hazard is typically minor in the short term, although over time they can add up to significant impacts. Road closures or detours during expansive soil repairs can result in temporary economic impacts.

Environment and Cultural Resources

Expansive soils are a natural environmental process. Nonetheless they have the potential to alter the landscape and can cause damages to historic and cultural resources.

Development Trends

Modern building practices incorporate mitigation techniques, provided proper geotechnical testing is employed to identify expansive soils. If areas prone to expansive soils are identified, future areas for development will need to take this hazard into account.

Risk Summary and Overall Significance by Jurisdictions

While there are areas of potential risk from expansive soils identified in the county, the HMPCs indicated that this hazard presents little to no impact to the Region. Overall, expansive soils are a low significance hazard for the counties in the region.

Table 4-37 Expansive Soil Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Limited	Occasional	Negligible	Low
Sublette	Limited	Occasional	Negligible	Low
Wind River Reservation	Limited	Occasional	Negligible	Low

4.2.8 Extreme Cold

Hazard/Problem Description

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities. Extreme cold temperatures can destroy crops and cause utility outages, leaving people without water or power until the utility companies are able to restore service.

What constitutes extremely cold temperatures varies across different areas of the United States, based on normal climate temperatures for the time of year. In Wyoming, cold temperatures are normal during the winter. When temperatures drop at least 20 degrees below normal winter lows, the cold is considered extreme and begins to impact the daily operations of the county. Extreme cold/wind chill impacts plants, animals and water supplies.

The effects of extremely cold temperatures are amplified by strong to high winds that can accompany winter storms. Wind-chill measures how wind and cold feel on exposed skin and is not a direct measurement of temperature. As wind increases, heat is carried away from the body faster, driving down the body temperature, which in turn causes the constriction of blood vessels, and increases the likelihood of severe injury or death to exposed persons. Animals are also affected by wind-chill however cars, buildings, and other objects are not.

Geographical Area Affected

The inherent nature of extreme cold makes it a regional threat, impacting most or all of the planning area simultaneously as well as extending the effects into the surrounding jurisdictions. Therefore, it is considered to have an extensive geographic impact rating. Lower elevations and valley bottoms can be more susceptible to trapping cold air.

Past Occurrences

The National Center for Environmental Information (NCEI) Storm Events Database recorded a total of 20 extreme cold and wind chill conditions since 1996 for all of Region 5. The following incidents included at least some portion of Region 5, and are good indicators of the types of impacts the region sees during an extreme cold event.

In late January 1996, record low temperatures were recorded for many areas, with 38 below zero recorded in Worland on the morning of January 31st. Low temperatures in the western Bighorn Mountains dropped to between ten below zero and 45 below zero during this time across the State of Wyoming. On the 1st, strong winds lowered wind chill temperatures to as low as 60 below zero in some locations. Some young livestock were frozen. The cold also froze many pipes and caused some water lines to break or leak. A number of schools and events were cancelled across the State during this time. About forty residences were without natural gas in the Big Horn Basin on the 3rd due to the cold causing a valve malfunction. Many

accidents occurred on the 1st due to poor visibility. One person froze to death just north of Buffalo, WY early on the 2nd after walking for help after his car broke down.

In mid-February 2004, bitter arctic air settled over parts of Wyoming. Overnight temperatures fell to 25 to 35 below zero on the 12th.

Unseasonably warm air over Wyoming during the first nine days of November 2014 was quickly ushered out of the state on November 10th. An air mass with origins in Siberia plunged south across western and central Wyoming and ushered in record cold temperatures. Casper set an all-time November record low temperature of 27 below zero on Wednesday, November 12th. This reading also shattered the old monthly record by 6 degrees. Low temperatures of 10 below zero to around 25 below zero were common across the area. Many locations not only set record low temperatures but also daily records for the lowest maximum temperature. A record low of 21 below zero was recorded in downtown Riverton on Thursday, November 13th. New record low maximum temperatures of 9 above zero, 4 above zero, and zero degrees were set on November 11th, 12th, and 13th, respectively.

On December 30th, 2014, northerly flow following the passage of an Arctic cold front brought brutally cold temperatures and dangerous wind chills to much of western and central Wyoming. The Daniel cooperative observer recorded a low temperature of -48F on the morning of Wednesday, December 31st. In addition, many locations across Fremont, Hot Springs, Lincoln, Sweetwater, and Washakie counties saw temperatures of -30F to -35F. Wind chill temperatures of -30F were common.

The following table shows regional temperature profiles based on data from the Western Regional Climate Center for sensor locations in each county. Note the record low of -46 degrees in Riverton in 1978.

Table 4-38 Region 5 Temperature Summaries

County	Station	Winter ¹ Average Minimum Temperature	Summer ¹ Average Maximum Temperature	Maximum Temperature	Minimum Temperature	# Days >90°F/ Year	# Days <32°F/ Year
Fremont	Riverton	4.0°F	85.0°F	104°F July 12, 1954	-46°F December 31, 1978	31	47
Sublette	Pinedale	1.1°F	75.7°F	94°F July 19, 1955	-49°F December 22, 1990	0	67
Wind River	Pavillion	10.2°F	82.9°F	102°F June 29, 1919	-42°F December 19, 1924	15	37

Source: Western Regional Climate Center, www.wrcc.dri.edu/

¹Winter: December, January, February; Summer: June, July, August

Frequency/Likelihood of Occurrence

Based on data provided by the HMPC and historical records, extreme cold and wind-chill is an annual occurrence in all counties in Region 5. Thus, this hazard has a high likelihood of occurrence. Events with high frequency of damages or lives lost occur much less frequently.

It is important to note that the lack of specific historical accounts on extreme cold temperatures does not necessarily indicate a low frequency of occurrence. Certain hazards occur more frequently in specific areas of the country and are considered more routine; the residents of these areas are less likely to report events

that seem commonplace in the planning area, even though the events may be considered extreme in other locations.

Changing Future Conditions

Climate change is projected to increase the uncertainty of weather patterns and produce more extreme climate induced events. Scientists have suggested that warming in the Arctic has been linked to changes in the jet stream which may lead to increased polar vortex events. The polar vortex is well documented and is described as large areas of low pressure and cold air surrounding the North and South poles. Increased temperatures in the polar regions have weakened and destabilized the jet stream leading to polar air to dip into lower latitudes, bringing it farther south than typical (UC Davis).

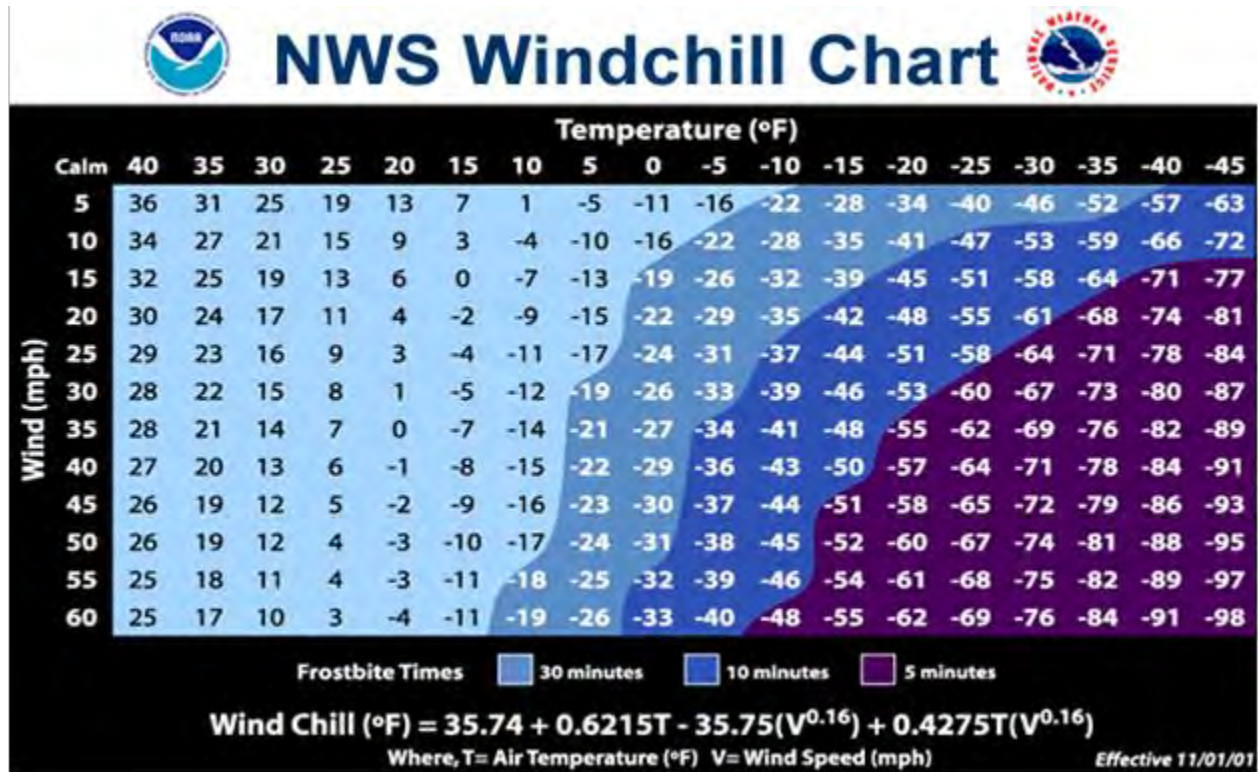
Potential Magnitude (Extent)

In order to calculate a magnitude and severity rating for comparison with other hazards, and to assist in assessing the overall impact of the hazard on the planning area, information from the event of record is used. In some cases, the event of record represents an anticipated worst-case scenario, and in others, it is a reflection of common occurrence. Based on the NCEI records, the event of record for extreme cold in the Region occurred on February 1, 1996. This event resulted in \$43,101 in damages (adjusted for 2021 dollars).

Overall, extreme temperature impacts would likely be limited in the Region, with 10 to 25 percent of the planning area affected. Extreme cold can occasionally cause problems with communications facilities and utility transmission lines. Danger to people is highest when they are unable to heat their homes and when water pipes freeze. Extreme cold can also impact livestock and even crops if the event occurs during certain times of the year.

In 2001, the NWS implemented an updated Wind-Chill Temperature index. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-23 National Weather Service Wind-Chill Chart



Source: National Weather Service

Vulnerability Assessment

Population

While everyone is vulnerable to extreme cold/wind chill events, some populations are more vulnerable than others. Extreme cold/wind chill pose the greatest danger to outdoor laborers, such as highway crews, police and fire personnel, and construction workers. The elderly, children, people in poor physical health, and the homeless are also vulnerable to exposure. Overall, the population has a medium exposure to severe cold.

General Property

Extreme cold/wind chill presents a minimal risk to the structures of Region 5. Property damage occurs occasionally when water pipes freeze and break. Homes without adequate insulation or heating may put owners at a higher risk for damages or cold-related injury. In cases of periods of prolonged cold, water pipes may freeze and burst in poorly insulated or unheated buildings. Vehicles may not start or stall once started due to the cold temperatures and the risks of carbon monoxide poisoning or structure fires increases as individuals attempt to warm cars in garages and use space heaters. Stalled vehicles, or those that fail to start, may result in minor economic loss if individuals are unable to commute between work, school, and home. Driving conditions may deteriorate if extreme cold/wind chill prolongs icy road conditions, which will impact commutes and emergency response times as well. Landscaping and agricultural products may be damaged or destroyed by unseasonable occurrences of extreme cold/wind chill, causing plants to freeze and die. This may increase the indirect vulnerabilities to severe cold by causing greater economic costs and losses for the year. The overall vulnerability of general property is low.

Critical Facilities and Lifelines

Like general property, extreme cold/wind chill events have a limited impact on the physical property of essential infrastructures and facilities. Communications lines such as fiber optic cables can freeze. There may be incidents of delayed emergency response due to stalled vehicles, delays in dispatching due to frozen communications lines, or an increased volume in calls. Hospitals may see an increase in cold-related injuries directly or injuries associated as secondary effects of the cold (traffic accidents, broken bones or severe cuts due to slips, etc.) and a prolonged extreme cold/wind chill event may impact hospital personnel capabilities. Personnel working in the cold, such as firefighters, EMTs, police officers and construction workers, have a higher vulnerability due to exposure times, and response capabilities may be hindered. Human services programs that care for at-risk individuals and families may be stressed, but usually can still adequately provide services through the duration of the extreme cold/wind chill event. Unusually high volumes of individuals seeking shelter or food may overwhelm some facilities if the event is prolonged. There may be an increased number of displaced individuals or families due to flooding caused by ruptured pipes, which may strain local aid organizations such as the Red Cross. If the event is extremely extended and impacts multiple other counties and states, which in turn impacts the availability of mutual assistance, the risk factors may increase. The overall vulnerability of essential infrastructure and community assets is medium.

Economy

A review of USDA Risk Management Agency (RMA) Records between 2007 and 2021 show a combined total of 3,579 acres lost to frost and freeze and \$749,576 in indemnity payments. All of these losses have occurred in Fremont County. Average annualized losses for crops due to frost and freeze is estimated to be \$53,541 for the entire region.

Environment and Cultural Resources

Older venues or historical properties suffer the same vulnerabilities associated with private and general properties that are older, with the added vulnerability of damaging historic and often irreplaceable property in the process. Natural resources may be damaged by extreme cold and freezing temperatures, including broken trees and death of wildlife. Unseasonable storms may damage or kill plants and wildlife, which may impact natural food chains until the next growing season. Most of these impacts would be short-term.

Development Trends

Due to the relative prevalence of cold incidents across the Region, it is common practice to build infrastructure with the appropriate safeguards to protect it from extreme cold incidents. This practice will continue as infrastructure is built to face the realities of living in Wyoming. However, new development can add stress to the electric grid, potentially increasing the possibility of brownouts or blackouts, though this is not anticipated with current development trends.

Pre-emptive cautions such as construction of green buildings that require less energy to heat, use of good insulation on pipes and electric wirings, and smart construction of walkways, parking structures, and pedestrian zones that minimize exposures to severe temperatures may help increase the overall durability of the buildings and the community to the variations. Continued development also implies continued population growth, which raises the number of individuals potentially exposed to variations. Public education efforts should continue to help the population understand the risks and vulnerabilities of outdoor activities, property maintenance, and regular exposures during periods of extreme cold.

Risk Summary and Overall Significance by Jurisdiction

Historically, impacts recorded from extreme cold in Region 5 include broken pipes, impacts to livestock and energy resources, and presents an exposure danger to the lives of people living, working and traveling through the Region. However, the climate of western Wyoming includes colder winters; while temperatures

can dip to very cold levels, residents have learned to adapt to these instances and consider most spells of cold part of the normal climatological routine.

Table 4-39 Extreme Cold Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Extensive	Highly Likely	Negligible	Low
Sublette	Extensive	Highly Likely	Negligible	Low
Wind River Reservation	Extensive	Highly Likely	Negligible	Low

4.2.9 Hail

Hazard/Problem Description

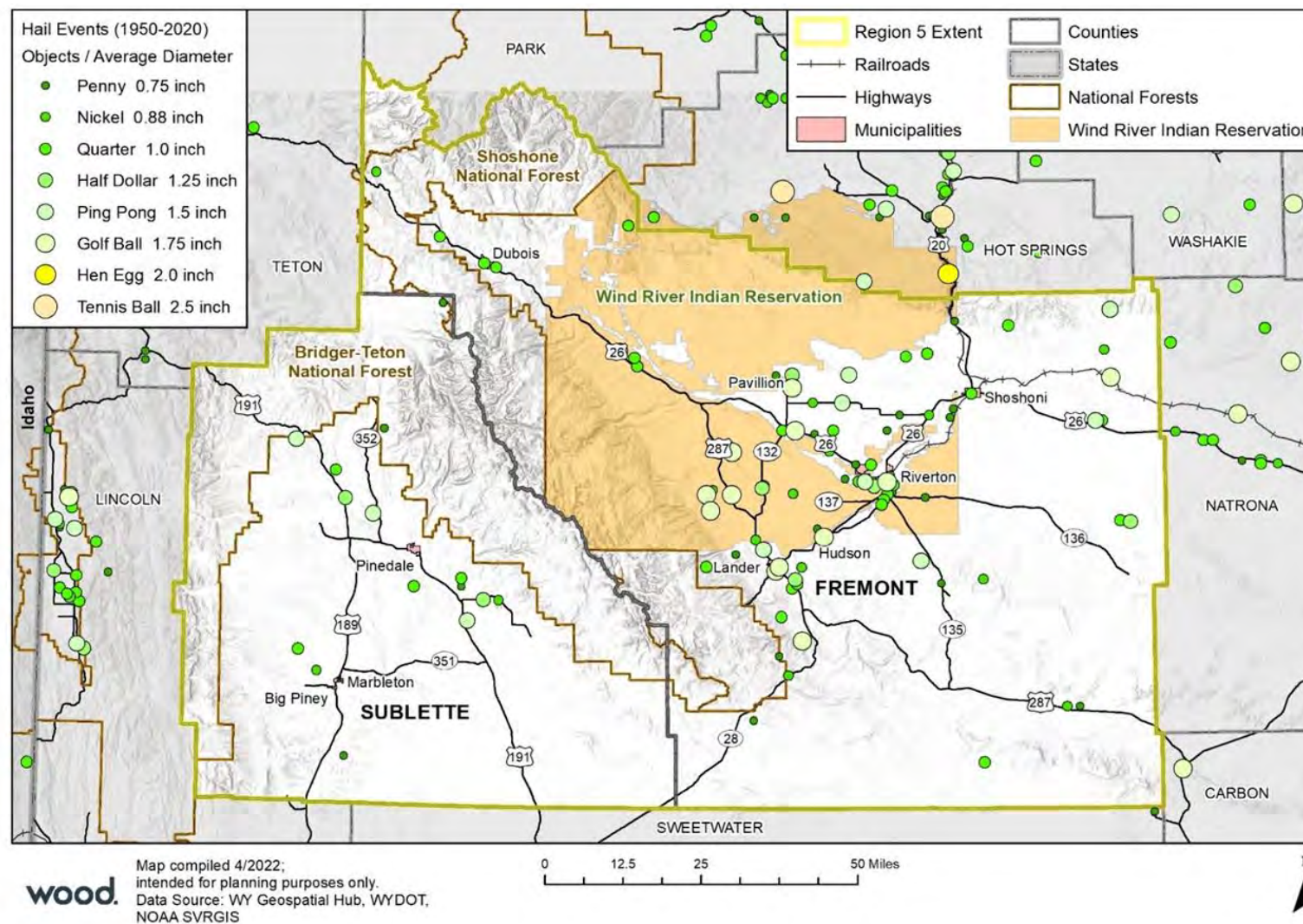
Damaging hail events occur sporadically throughout Region 5, usually associated with severe summer storms and wind events. Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where the raindrops freeze into ice. Recent studies suggest that super-cooled water may accumulate on frozen particles near the backside of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air or grow too heavy and fall to the ground. The NOAA National Severe Storms Laboratory reports that the smallest sized hailstones (less than 1-inch in diameter) are expected to fall between 9 and 25 mph, larger hailstones (between 2-inches and 4-inches in diameter) can fall at speeds up to 72 mph.

Hailstones grow two ways: by wet growth or dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When the tiny piece of ice collides with a supercooled drop, the water does not freeze on the ice immediately. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones grow when the air temperature is well below freezing and the water droplet freezes immediately as it collides with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice. Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are “balanced” in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail.

Geographic Area Affected

Hail can strike anywhere in the Region; therefore, geographic area of hail is ranked as **extensive**. The NOAA reports that Wyoming, Nebraska, and Colorado historically have the most hailstorms because of lower freezing levels in the area, or a lower altitude at which the temperature is below freezing when compared to places like Florida. The area where these states meet has become known as “hail alley”. Hailstorms occur during severe storms, which are regional in nature. However, just as the amount of precipitation in the form of snow or rain may vary significantly within a single storm, so may the amount, size, and duration of hail within a severe storm. Greater losses from hail events are likely to occur in cities, such as Riverton, due to the concentration of infrastructure that can sustain damages. Figure 4-24 shows the location of past hail events in the region.

Figure 4-24 Historic Hail Events (1955-2021)



Source: NCEI, 1955-2021

Past Occurrences

According to the NOAA National Severe Storms Laboratory, Wyoming averages seven to nine days of hail annually. A summary of historic hail events in Region 5 is included in Table 4-40 and details of the most significant events that either caused damages or produced hail equal to or greater than 1.5 inches in diameter are listed in Table 4-41. Information on historic crop damages due to hail events in Region 5 can be found in Table 4-42. The historic hail size and property loss data in these tables was derived from the NCEI Storm Events Database from 1955-2021 and the crop damage data was derived from the USDA Risk Management Agency Database from 2007-2021. There has been no USDA Disaster Designations related to hail in Fremont or Sublette County.

The NCEI records any hail events with hailstones that are .75 inch or larger in diameter, or any hail of a smaller diameter which causes property damage, crop damage, injuries, or casualties. According to the NCEI definition, there have been 110 documented hail events impacting Region 5 since 1955. Two of these hail events were extensive enough to impact both Fremont and Sublette Counties. The cumulative hail incidents had a total recorded property damage of \$25,500 and a total recorded crop damage of \$608,226. While these recorded values can be used as an indicator for the extent of damages hail can cause in the region, it is important to note that NCEI data only includes reported losses, so it is possible that actual damages exceed these values. No deaths and or injuries have been associated with these storms in the region during this timeframe.

Table 4-40 Summary Hail History 1955-2021, Region 5

County	Incidences
Fremont	98
Sublette	14
Total Events	112

Source: National Center for Environmental Information (NCEI)

Table 4-41 Region 5 Hail History with Size Greater than 1.5 inches or Significant Damages 1955-2021

County	Location	Date	Hail Diameter Size (Inches)	Fatalities	Injuries	Property Damage
FREMONT		9/8/1973	1.75	0	0	\$0.00
SUBLETTE		6/6/1981	1.75	0	0	\$0.00
FREMONT		6/24/1982	1.75	0	0	\$0.00
FREMONT		6/14/1984	1.75	0	0	\$0.00
FREMONT		7/14/1984	1.75	0	0	\$0.00
SUBLETTE	CORA	8/12/1997	1.5	0	0	\$0.00
FREMONT	LYSITE	7/2/1998	1.5	0	0	\$0.00
FREMONT	FT WASHAKIE	6/17/1999	1.75	0	0	\$0.00
FREMONT	RIVERTON	5/17/2000	1.5	0	0	\$0.00
FREMONT	HUDSON	5/27/2001	1.75	0	0	\$0.00
FREMONT	LANDER	9/14/2001	1.75	0	0	\$0.00
FREMONT	LYSITE	6/16/2003	1.75	0	0	\$0.00
FREMONT	FT WASHAKIE	6/28/2003	1.75	0	0	\$0.00
FREMONT	RIVERTON	8/17/2003	1.75	0	0	\$0.00

County	Location	Date	Hail Diameter Size (Inches)	Fatalities	Injuries	Property Damage
SUBLETTE	NEW FORK	6/19/2004	1.5	0	0	\$0.00
FREMONT	MILFORD	5/21/2008	1.5	0	0	\$0.00
FREMONT	RIVERTON	6/13/2009	1.5	0	0	\$0.00
FREMONT	KINNEAR	7/4/2009	0.75	0	0	\$25,000.00
FREMONT	MINERS DELIGHT	7/28/2009	1.75	0	0	\$0.00
FREMONT	CROWHEART	6/30/2013	1.5	0	0	\$0.00
FREMONT	MIDVALE	6/4/2015	1.5	0	0	\$0.00
SUBLETTE	WARREN BRIDGE	9/4/2016	1.5	0	0	\$0.00
FREMONT	MIDVALE	6/15/2019	1.5	0	0	\$0.00
FREMONT	MONETA	8/21/2019	1.5	0	0	\$500.00
Totals				0	0	\$25,500.00

Source: National Center for Environmental Information (NCEI)

Table 4-42 Region 5 Summary of Crop Damage due to Hail 2007-2021

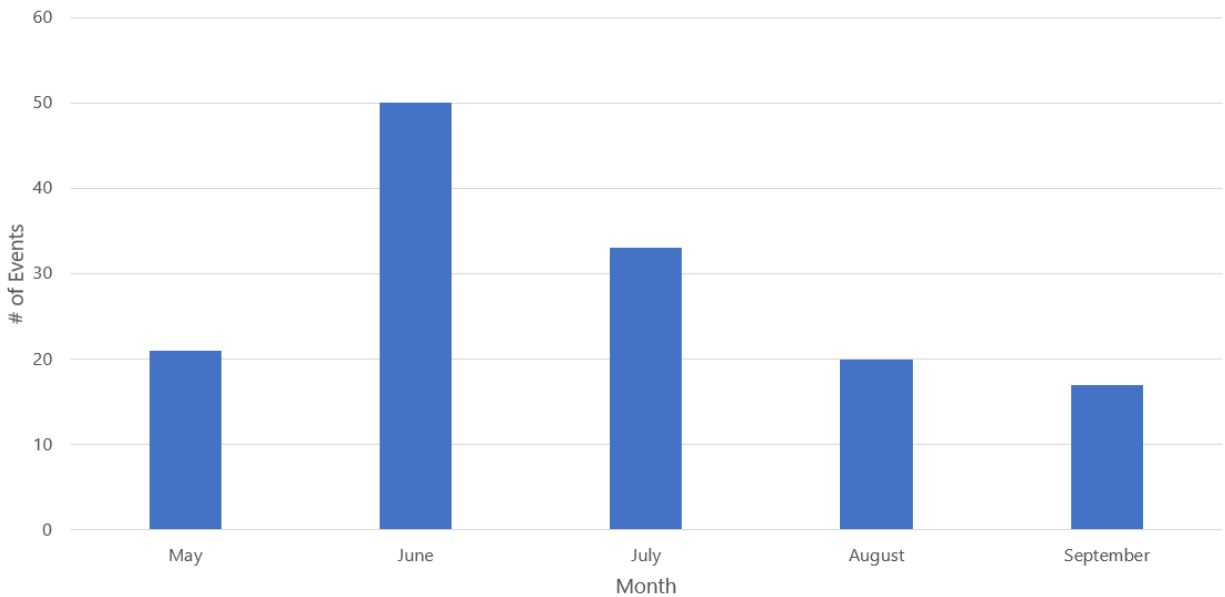
Region 5 Crop Loss Events (2007-2021)			
County Impacted	Total Number of Events	Total Crop Damage	Net Acres Lost
Fremont	35	\$608,226	3,729

Source: United States Department of Agriculture (USDA)

Frequency/Likelihood of Occurrences

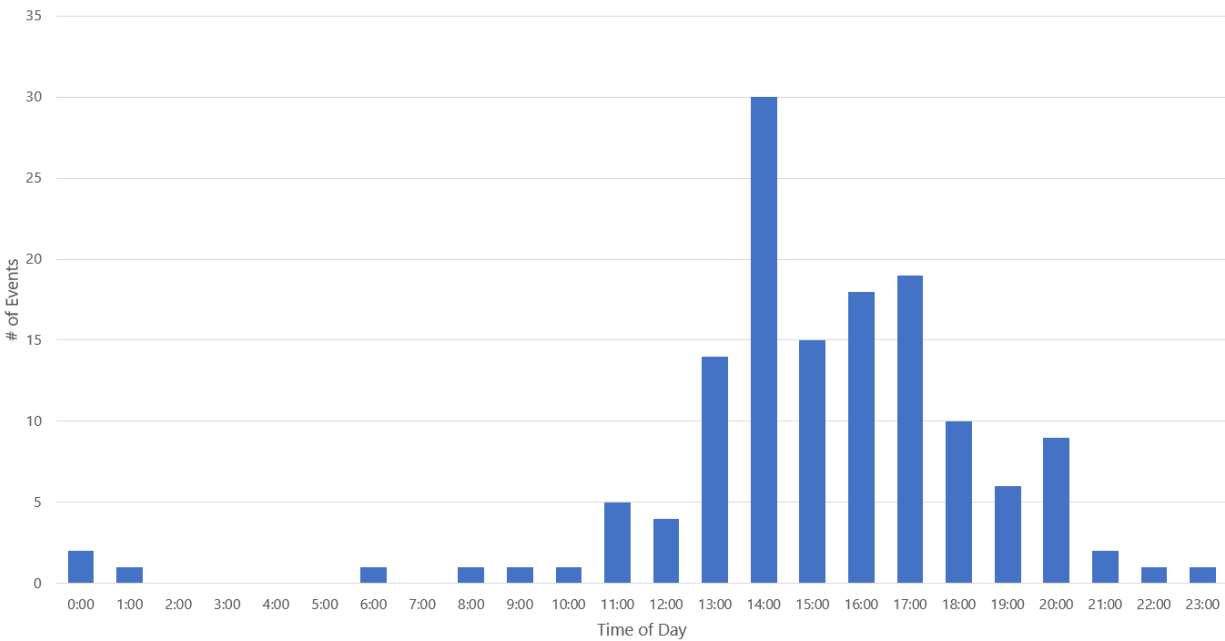
Region 5 has experienced 112 hail incidents (110 days with incidents) over 64 years: this correlates to 1.72 days with incidents each year; therefore, frequency of hail events in Region 5 is ranked as **highly likely**. Based on historical data, an average hail event in Region 5 occurs in the summer months, with a peak in the number of events in June and happens in the afternoon around 2:00 p.m., as shown in Figure 4-25 and Figure 4-26. The NCEI data shows that hail events in Region 5 are typically less than 1 inch in diameter, shown in Figure 4-27. There were no recorded incidents of hail larger than 1.75 inches in diameter in the NCEI dataset.

Figure 4-25 Region 5 Historic Hail Month 1955-2021



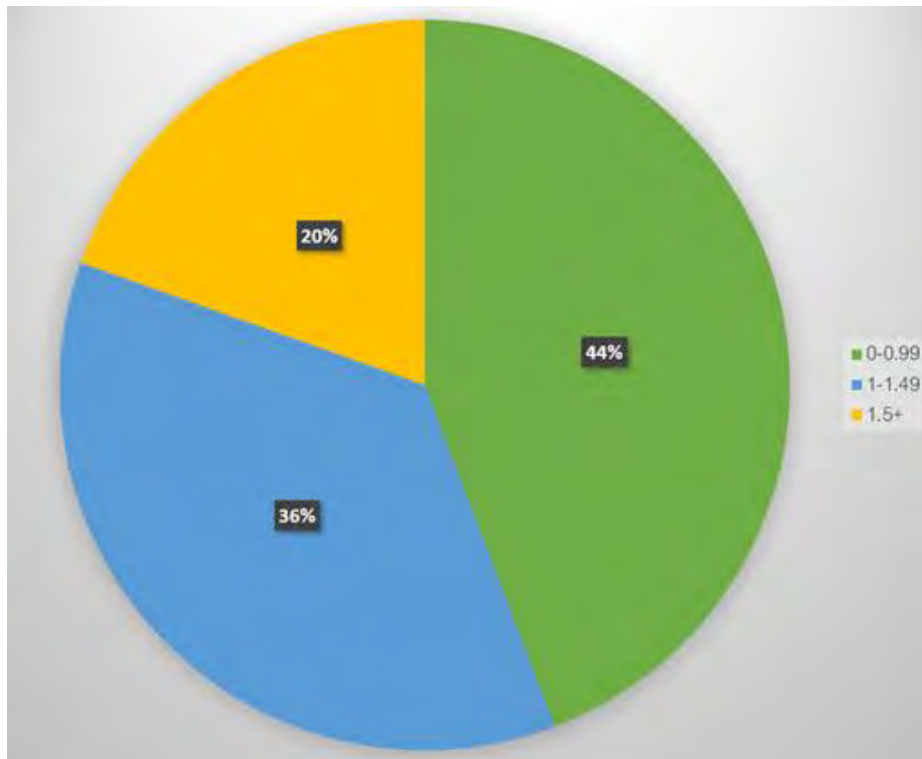
Source: data provided by NCEI; illustration created by Wood

Figure 4-26 Region 5 Historic Hail Time of Day 1955-2021



Source: data provided by NCEI; illustration created by Wood

Figure 4-27 Region 5 Historic Hail Size 1955-2021



Source: data provided by NCEI; illustration created by Wood

Potential Magnitude

Most public and private property damage from hail is insured under private property insurance or crop insurance policies, serviced by multiple insurance providers; it is very difficult to get a true cumulative estimate of damage costs caused by hail events. Data collection regarding dollar damage to public and private property holds significant gaps for this reason. There have been no FEMA disaster or state declarations for the counties in Region 5 related to damaging hail, and no USDA disaster declarations because of hail damage were found. Agricultural losses and claims met by crop insurance carriers due to hail damage are difficult to determine. The USDA reported crop damage from 34 hail events since 2007 in Fremont County, totaling to \$608,226 in losses, with costliest damages impacting dry bean and corn crops. There was no crop damage reported in Sublette County in the dataset. While hail can cause crop and property damage, most damages are insured. Additionally, people are rarely reported to suffer significant injury from hail events; therefore, potential magnitude from hail is ranked as **limited**.

The National Weather Service (NWS) classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-43 indicates the hailstone measurements utilized by the NWS. There is no clear distinction between storms that do and do not produce hailstones. Nearly all severe thunderstorms produce hail aloft, though it may melt before reaching the ground. Multi-cell thunderstorms produce many hailstones, but not usually the largest hailstones. In the life cycle of the multi-cell thunderstorm, the mature stage is relatively short so there is not much time for growth of the hailstone. Supercell thunderstorms have sustained updrafts that support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud. In general, hail 2 inches (5 cm) or

larger in diameter is associated with supercells (a little larger than golf ball size, which the NWS considers to be 1.75 inch.). Non-supercell storms are capable of producing golf ball sized hail.

The largest size of hail reported by the NCEI in Region 5 was 1.75 inches, or golf ball sized. The NCEI reported 16 different events with this sized hail. These large hail events primarily took place in Fremont County, but once in Sublette County.

Table 4-43 National Weather Service Hail Severity

Severity	Description	Hail Diameter Size (in inches)
Non-Severe Hail Does not typically cause damage and does not warrant severe thunderstorm warning from NWS.	Pea	1/4"
	Marble/mothball	1/2"
	Penny	3/4"
	Nickel	7/8"
Severe Hail Research has shown that damage occurs after hail reaches around 1" in diameter and larger. Hail of this size will trigger a severe thunderstorm warning from NWS.	Quarter	1" (severe)
	Half Dollar	1 1/4"
	Walnut/Ping Pong Ball	1 1/2"
	Golf Ball	1 3/4"
	Hen Egg/Lime	2"
	Tennis Ball	2 1/2"
	Baseball	2 3/4"
	Teacup/Large Apple	3"
	Softball	4"
	Grapefruit	4 1/2"

Source: National Weather Service (NWS)

Changing Future Conditions

As the atmosphere warms further due to climate change, the increased heat provides more energy for severe storms. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability of severe weather events increases in a warmer climate. The changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. All these impacts could have significant economic consequences.

Vulnerability Assessment

People

Exposure is the greatest danger to people from hail for those caught outside in the open without shelter. This includes outdoor enthusiasts, outdoor workers, and homeless populations. Large hail has the potential to cause significant bruising, concussions, the potential for broken bones, and even death. The impacts of hail on vulnerable populations can be more severe. People without shelter can also be injured by exposure to hailstorms, though there is very little historical reference for this occurring in the Region. Most injuries caused by hail are minor and go unreported.

Property

Hail can strike anywhere in the region and all structures are vulnerable. Hail can damage roofs, shingles, windows, siding, unsheltered vehicles, and any other property unprotected from the storm. Hail causes more than a billion dollars of property damage nationally each year. Most of this damage is to crops, but hail can also decimate structural sidings, shatter windows, peel paint, and severely damage automobiles

and equipment not protected or stored inside. NCEI reported that on August 21st, 2019, a hailstorm that crossed the highway in eastern portions of Fremont County produced hail the size of ping-pong balls and damaged a truck.

Critical Facilities and Lifelines

Hail can lead to the temporary incapacitation of roads when small hail stones build up so deep that they block roads. An example of this was reported in Fremont County on July 4th, 2009, when hail accumulated up to 3 or 4 inches on Highway 26. Hail has also been observed to block storm drains and prevent proper runoff, potentially resulting in flooding as a secondary hazard. Most structures, including the Region's critical facilities, should be able to provide adequate protection from hail but the structures could suffer broken windows and dented exteriors. Those facilities with back-up generators are better equipped to handle a severe weather situation should the power go out.

Economy

The economic impact from hail can be severe on impacted areas, and potentially long lasting. Reported direct damages to crops and property have totalled over \$633,000 in Region 5 over the last 64 years, but severe indirect economic impacts can also be felt through businesses forced to close for repairs. A review of the USDA Risk Management Agency records shows between 2007 and 2021 the Region has had a total of 3,379 acres of crops lost to hail in Fremont County.

Environment and Cultural Resources

While hail is a natural environmental process, it can cause significant environmental damage, breaking tree limbs, damaging trees, and other plants in bloom, and destroying crops. Some cultural and historic properties may also potentially be at risk of damage from hail.

Development Trends

Hail can strike anywhere in the Region, so any growth or new development in the counties will increase exposure to hail damage. Insurance will be an important tool to offset the potentially substantial dollar losses associated with hail. Areas with high concentration of infrastructure are likely to see greatest economic losses from damages caused by hail events.

Risk Summary and Overall Significance by Jurisdiction

The counties and Reservation in Region 5 will continue to experience risks from hail on an annual basis. Hail damage to property is expected to be highest in the municipalities; much of the damage to both property and crops is covered under insurance policies.

Table 4-44 Hail Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Fremont	Extensive	Highly Likely	Limited	Medium
Sublette	Extensive	Highly Likely	Limited	Medium
Wind River Reservation	Extensive	Highly Likely	Limited	Medium

4.2.10 Hazardous Materials

Hazard Description

Generally, a hazardous material is a substance or combination of substances which, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either (1) cause or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible, illness; or (2) pose a substantial present or potential hazard to human health or environment when

improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous material incidents can occur while a hazardous substance is stored at a fixed facility, or while the substance is being transported.

The U.S. Department of Transportation, U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) all have responsibilities in regard to hazardous materials and waste. The Emergency Planning and Community Right-to-Know Act (EPCRA) requires certain regulated entities to report information about hazardous chemicals and substances at their facilities to federal, state, and local authorities. The objective is to improve the facilities, or government agency's ability to plan for and respond to chemical emergencies, and to give residents information about chemicals present in their communities. EPCRA also mandates the creation of State Emergency Response Commissions (SERCs) and Local Emergency Planning Committees (LEPCs). The Right to Know Network (RTK NET) is a primary source of information on the use and storage of hazardous materials, as well as data regarding spills and releases.

The U.S. Department of Transportation has identified the following classes of hazardous materials:

- Explosives
- Compressed gases: flammable, non-flammable compressed, poisonous
- Flammable liquids: flammable (flashpoint below 141 degrees Fahrenheit) combustible (flashpoint from 141 – 200 degrees)
- Flammable solids: spontaneously combustible, dangerous when wet
- Oxidizers and organic peroxides
- Toxic materials: poisonous material, infectious agents
- Radioactive material
- Corrosive material: destruction of human skin, corrodes steel

Region 5 is home to several gas plants, refineries and mines, and numerous pipelines and rail lines run across the Region, creating a likely potential for hazardous materials releases.

It is also common to see hazardous materials releases as escalating incidents resulting from other hazards such as floods, wildfires, and earthquakes. The release of hazardous materials can greatly complicate or even eclipse the response to the natural hazards disaster that caused the spill.

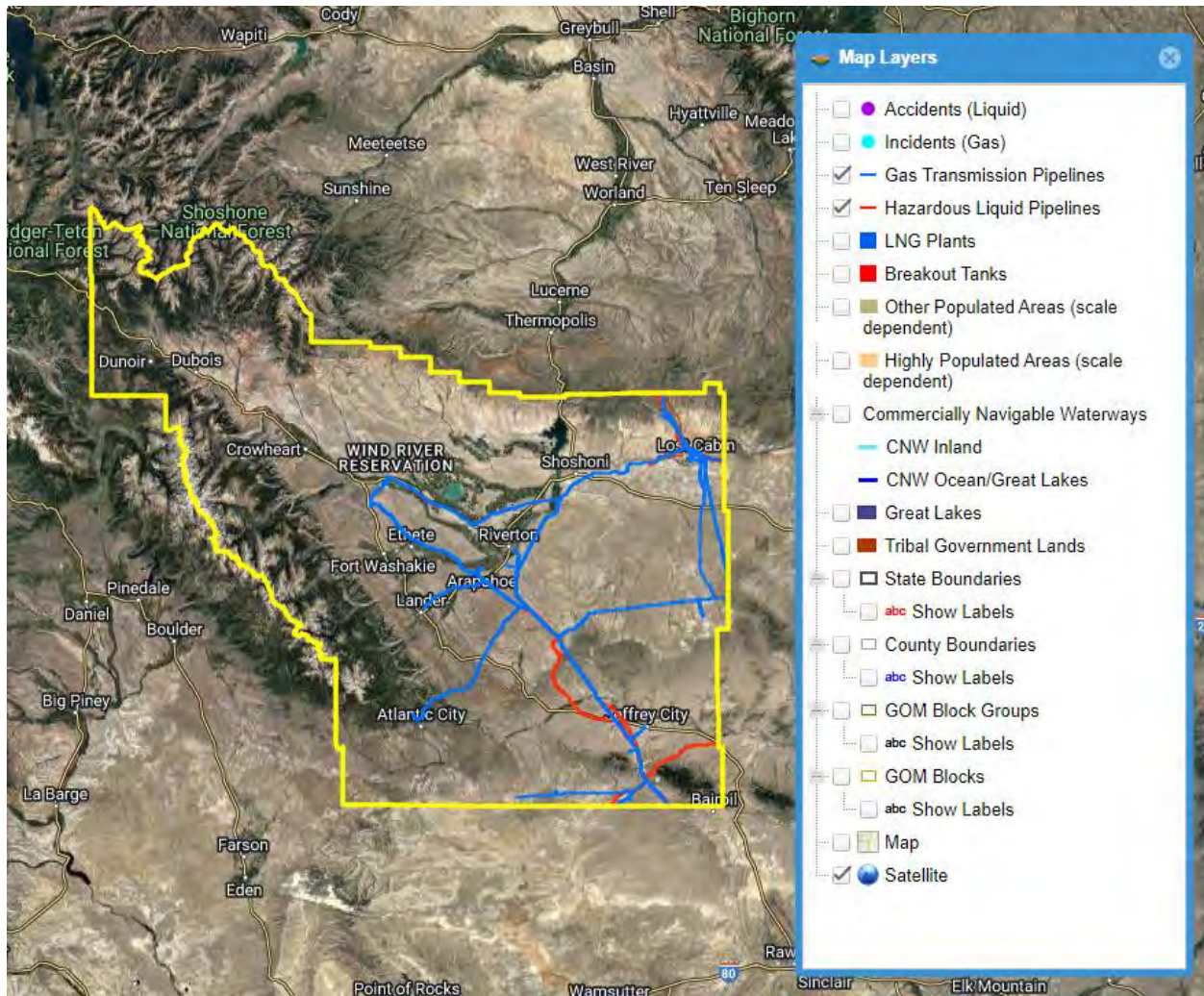
Geographical Areas Affected

Hazmat incidents can occur at a fixed facility or during transportation. Hazardous materials facilities are identified and mapped by the counties they reside in, along with the types of materials stored there; facilities generally reside in and around communities. Some facilities contain extremely hazardous substances; these facilities are required to generate Risk Management Plans (RMPs) and resubmit these plans every five years. RMP facility information can be found within individual jurisdiction annexes.

The Wind River Reservation HMPC noted the railroad running through the Wind River Canyon as historically hazardous and creating great risk to the river and downstream reservoir; the HMPC noted that trains have derailed along the route in the past.

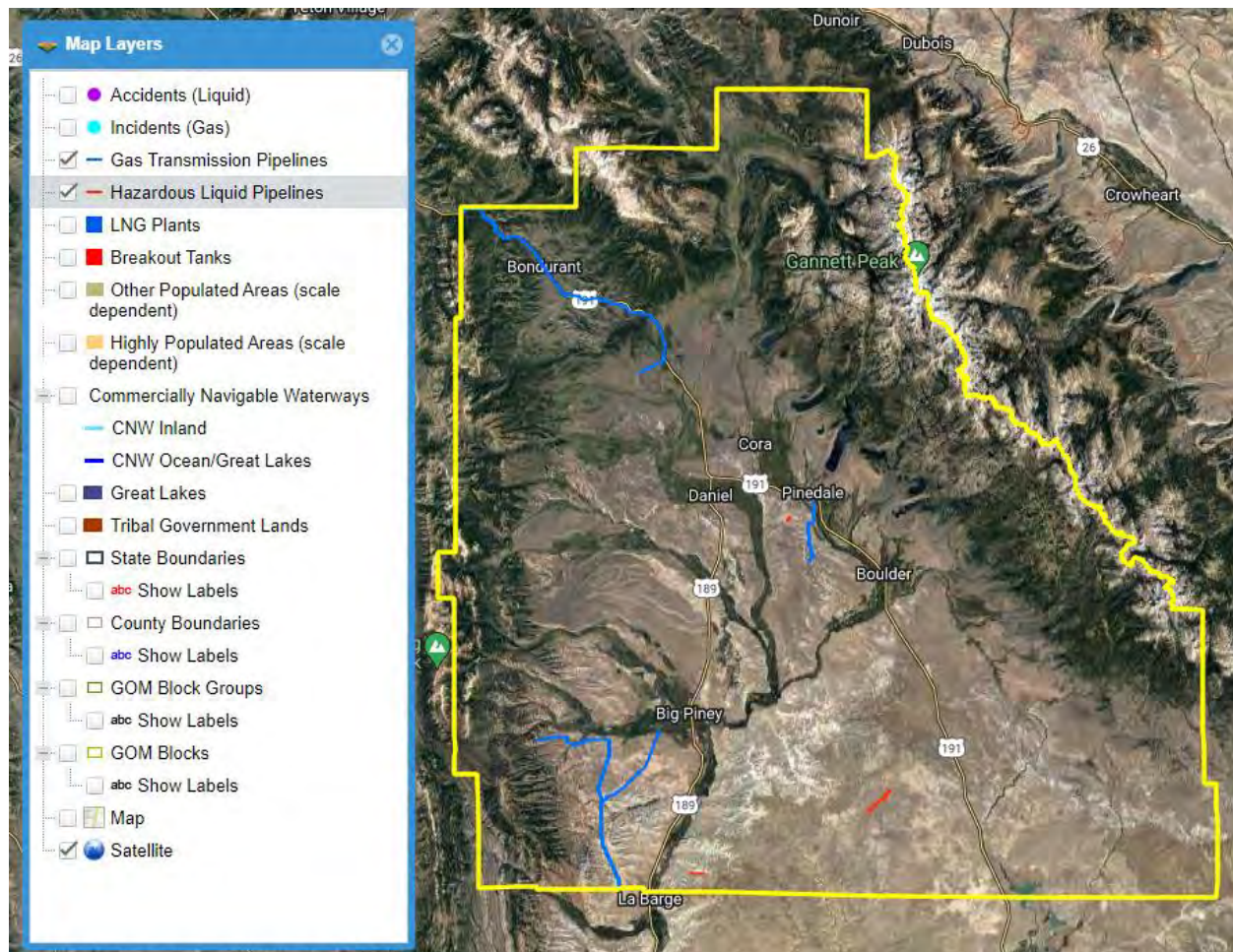
In transit, hazardous materials generally follow major transportation routes where possible (including road, rail and pipelines), creating a risk area immediately adjacent to these routes. Information provided by the National Pipeline Mapping System (NPMS) indicate several pipelines conveying gas or hazardous liquids cross the planning area, these are shown in Figure 4-28 through Figure 4-31 below. Pipeline ruptures can result in major spills, or even explosions.

Figure 4-28 Pipelines Located Within Fremont County and Wind River Reservation



Source: National Pipeline Mapping System

Figure 4-29 Pipelines Identified Within Sublette County

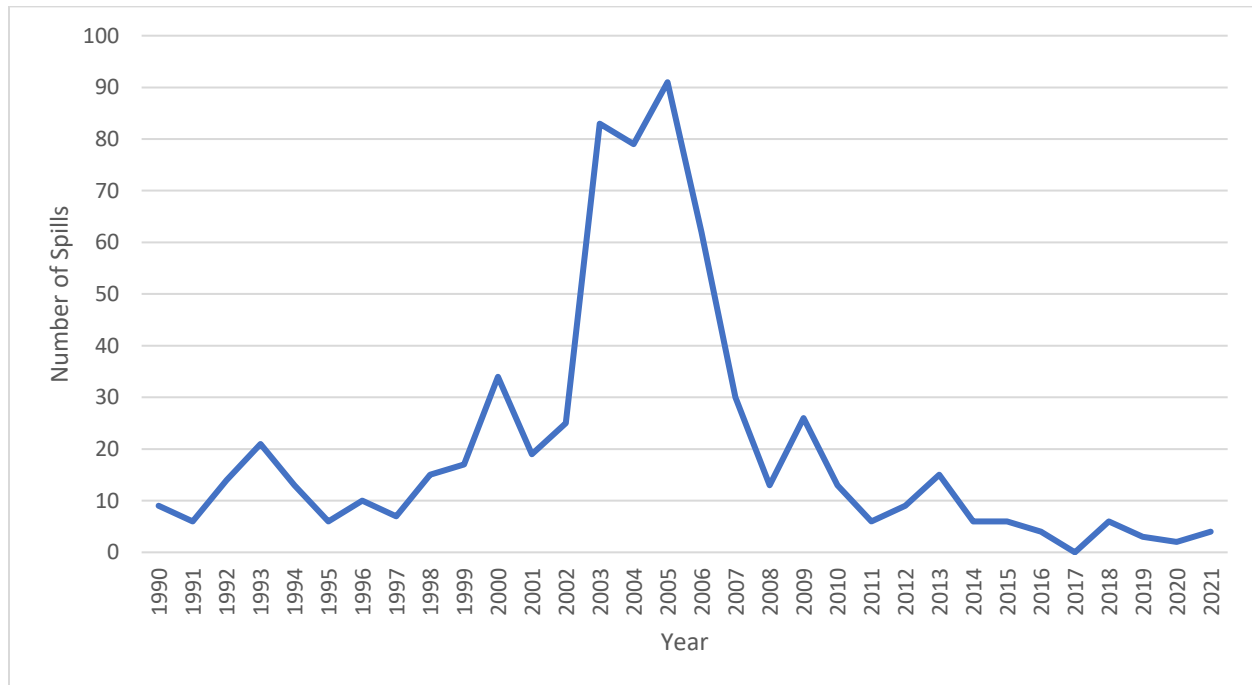


Source: National Pipeline Mapping System

Past Occurrences

There are a variety of mechanisms to get an idea of the number and types of historical hazardous materials spills in the Region. One such repository is the catalog of hazardous materials spill and accident reports at the National Response Center (NRC) as part of the Right to Know Network (RTK NET). According to this database, between 1990 and 2021 there were 654 incidents reported across the 2 counties in the region. (<http://www.rtknet.org/db/erns>) The figure below shows a ten-year record for reported incidents in Region 5.

Figure 4-30 Hazardous Materials Spills/ Accidents Reported to the NRC Region 5: 1990-2021



Source: National Response Center Incident Report Database

According to the data, during the time period between 1990 and 2021 the Region saw an average of 21 NRC-reported incidents per year, which means that each county can reasonably expect multiple hazardous materials responses annually. The county data is further broken down in the table below:

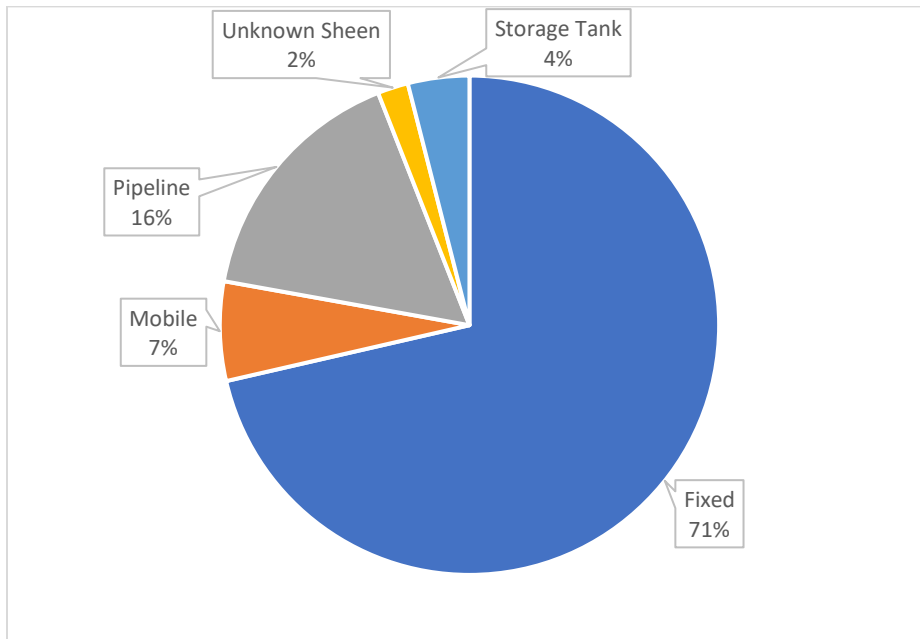
Table 4-45 Average NRC-Reported Incidents by County and Decade

Year	Fremont	Sublette
1990s	9	3
2000s	16	27
2010s	5	2
2020s	2	1

Source: National Response Center Incident Report Database

According to the HMPCs, small-level hazardous materials incidents occur frequently throughout the year in Region 5. During discussions, the committees noted roads, rail and pipelines throughout the Region. The NRC also tracks incidents by type. The following figure shows the percentage of each type of incident over the 10-year period between 1990 and 2021.

Figure 4-31 Hazardous Materials Incidents Reported to the NRC by Type – Region 5: 1990-2021



Source: National Response Center Incident Report Database

In addition to local first responders, eight Regional Emergency Response Teams (RERT) across the State of Wyoming respond to a variety of incidents, including those incidents involving hazardous materials. The Region 5 RERT is located in Riverton, in Fremont County.

Frequency/Likelihood of Future Occurrence

The Region experiences multiple hazardous materials incidents each year, with various degrees of impact; there is a 100% chance that the Region will see a hazardous materials incident in any given year. Hazardous material spills and releases, both from fixed facilities and during transport, will continue to occur in each county in Region 5 annually.

Changing Future Conditions

Changes in future conditions are unlikely to impact the rates of occurrence for human-caused hazards, such as hazardous material incidents. However, it is possible that an increase or change in the occurrence of other hazards, such as severe storms and fire events, may increase the likelihood of an accidental hazardous materials releases from transportation incidents.

Potential Magnitude (Extent)

Impacts that could occur from hazardous waste spills or releases include:

- Injury
- Loss of life (human, livestock, fish and wildlife)
- Evacuations
- Property damage
- Air pollution
- Surface or ground water pollution/contamination
- Interruption of commerce and transportation

Numerous factors go into the ultimate impacts of a hazardous materials release, including method of release, the type of material, location of release, weather conditions, and time of day. This makes it difficult to nail down precise impacts. Hazardous materials found in Region 5 will have at least one of the impacts listed above, and probably more.

Vulnerability Assessment

Region 5 has energy pipelines, railroad tracks which carry many types of hazardous materials, and state highways running through its boundaries. A variety of hazardous materials originating in the Region or elsewhere are transported along these routes and could be vulnerable to accidental spills. Consequences can vary depending on whether the spill affects a populated area vs an unpopulated but environmentally sensitive area.

No specific hazardous materials routes are designated in Region 5; any routes used to carry hazardous materials introduce an element of risk of materials release to the area immediately adjacent to them. The Region noted that many petroleum and other flammable products are transported by truck, and many have mixed payloads that don't list material amounts. Extractive industries were identified as the biggest source of hazardous materials within and moving through the county.

The Fremont County HMPC noted that a short commodity flow study was done for Lander, Riverton and Shoshoni. The HMPC also noted that much of the hazmat traffic across the county is flammable petroleum products, many with mixed payloads that don't list amounts. The HMPCs for both Fremont County and the Wind River Reservation also noted the prevalence of truck traffic from the Chem Trade asset plant (along with the plant itself), and that the railroad goes through the northern part of the county.

The Sublette County HMPC noted that there have been no commodity flow studies conducted in the County; studies such as these would give the County a better idea of what is moving along transportation routes, and its potential impacts.

Each Planning Team noted that extractive industries are by far the largest source of hazardous materials.

People

Hazardous materials incidents can cause injuries, hospitalizations, and even fatalities to people nearby. People living near hazardous facilities and along transportation routes may be at a higher risk of exposure, particularly those living or working downstream and downwind from such facilities. For example, a toxic spill or a release of an airborne chemical near a populated area can lead to significant evacuations and have a high potential for loss of life.

In addition to the immediate health impacts of releases, a handful of studies have found long term health impacts such as increased incidence of certain cancers and birth defects among people living near certain chemical facilities. However there has not been sufficient research done on the subject to allow detailed analysis.

Property

The impact of a fixed hazardous facility, such as a chemical processing facility is typically localized to the property where the incident occurs. The impact of a small spill (i.e. liquid spill) may also be limited to the extent of the spill and remediated if needed. A blanket answer for potential impacts is hard to quantify, as different chemicals may present different impacts and issues. Property within a half mile in either direction of designated hazardous materials routes is at increased risk of impacts. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to property. However, some larger incidents involving pipelines, railroads, or explosive materials may cause significant and overwhelming damage to the surrounding communities.

Critical Facilities and Lifelines

Impacts of hazardous material incidents on critical facilities are most often limited to the area or facility where they occurred, such as at a transit station, airport, fire station, hospital, or railroad. However, they can cause long-term traffic delays and road closures resulting in major delays in the movement of goods and services. These impacts can spread beyond the planning area to affect neighboring counties, or vice-versa. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to critical facilities.

There are nine Risk Management Plans (RMP) facilities located in Region 5, as noted in Table 4-46 below. Some of these are discussed in more detail in the Annexes.

Table 4-46 RMP Facilities in Region 5

County	Community	Number of Facilities
Fremont	Riverton	2
	Lysite	1
	Pavillion	1
	Shoshoni	1
Sublette	Boulder	1
	LaBarge	1
	Pinedale	1
	Big Piney	1
Total		9

Source: National Response Center Incident Report Database

Economy

Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. In a larger scale incident, cleanup can be extensive and protracted. There can be deaths or injuries requiring doctor's visits and hospitalization, disabling chronic injuries, soil and water contamination can occur, necessitating costly remediation. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach \$1 million or more in direct damages.

Environmental and Cultural Resources

Hazardous material incidents may affect a small area at a regulated facility or cover a large area outside such a facility. Widespread effects occur when hazards contaminate the groundwater and eventually the municipal water supply, or they migrate to a major waterway or aquifer. Impacts on wildlife and natural resources can also be significant. These types of widespread events may be more likely to occur during a transportation incident, such as a pipeline spill, and can have far reaching and devastating impacts on the natural environment and habitats.

Development Trends

Future development is expected to increase the number of people potentially exposed to the impacts of hazardous materials incidents. The number of hazardous materials that are stored, used, and transported across the County may continue to increase over the coming years if regional growth continues. However, according to the 2021 Wyoming State Hazard Mitigation Plan, the number of hazardous materials incidents occurring annually have been trending downward since a statewide peak in 2005.

Risk Summary and Overall Significance by Jurisdiction

Table 4-47 Hazardous Materials Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Limited	Highly Likely	Limited	Low
Sublette	Limited	Highly Likely	Limited	Low
Wind River Reservation	Limited	Highly Likely	Limited	Low

4.2.11 High Winds and Downbursts

Hazard/Problem Description

Wind, because of its constant presence in Wyoming, can be overlooked as a hazard. However, wind can be a highly destructive hazard and warrants review in Region 5. Wyoming's wind is also becoming an economic factor as renewable wind energy is developed around the state. High winds exacerbate snow conditions and cause road conditions to deteriorate.

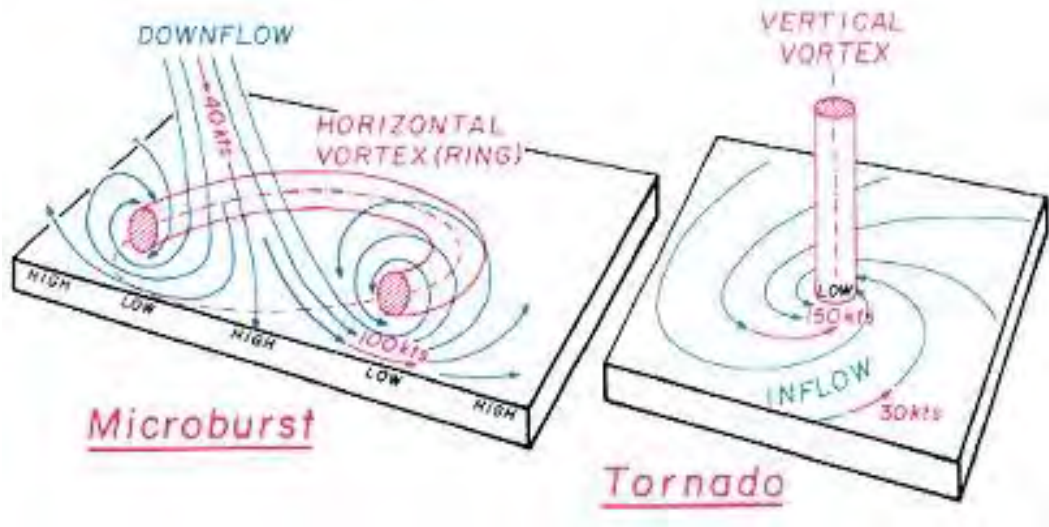
This profile examines the hazard that high winds present including downbursts, a subcategory of high winds usually associated with thunderstorms. A downburst is a strong downdraft which causes damaging winds on or near the ground. Downbursts are much more frequent than tornadoes, and for every tornado there are approximately 10 downburst damage reports. Downbursts can be associated with either a heavy precipitation or non-precipitation thunderstorm (dry or wet downbursts), and often occur in the dissipating stage of a thunderstorm. Microbursts and macrobursts are categories of downbursts, classified by length of duration, velocity of wind, and radius of impact.

Microbursts generally last between 5 and 15 minutes and impact an area less than three miles wide. Macrobursts can last up to 30 minutes with winds up to 130 miles per hour and can impact areas larger than three miles in radius. Microbursts and macrobursts may induce dangerous wind shears, which can adversely affect aircraft performance, cause property damage and loss of life.

A downburst can occur when cold air begins to descend from the middle and upper levels of a thunderstorm (falling at speeds of less than 20 miles an hour). As the colder air strikes the Earth's surface, it begins to 'roll' outward. As this rolling effect happens, the air expands causing further cooling and having the effect of pulling the shaft of air above it at higher and higher speeds.

Downbursts can be mistaken for tornadoes by those that experience them since damages and event characteristics are similar. Figure 4-32 illustrates the difference between these hazards. Tornado winds can range from 40 mph to over 300 mph. Downbursts can exceed winds of 165 mph and can be accompanied by a loud roaring sound. Both downbursts and tornadoes can flatten trees, cause damage to homes and upend vehicles. In some instances, aerial surveying is the best method to determine what kind of event has taken place, as seen in Figure 4-33. In this photograph, trees are blown down in a straight line, which is a very strong indication of a downburst as opposed to a tornado.

Figure 4-32 Schema of Microburst and Tornado



Source: www.erh.noaa.gov

Figure 4-33 Aerial Image of Downburst Damage

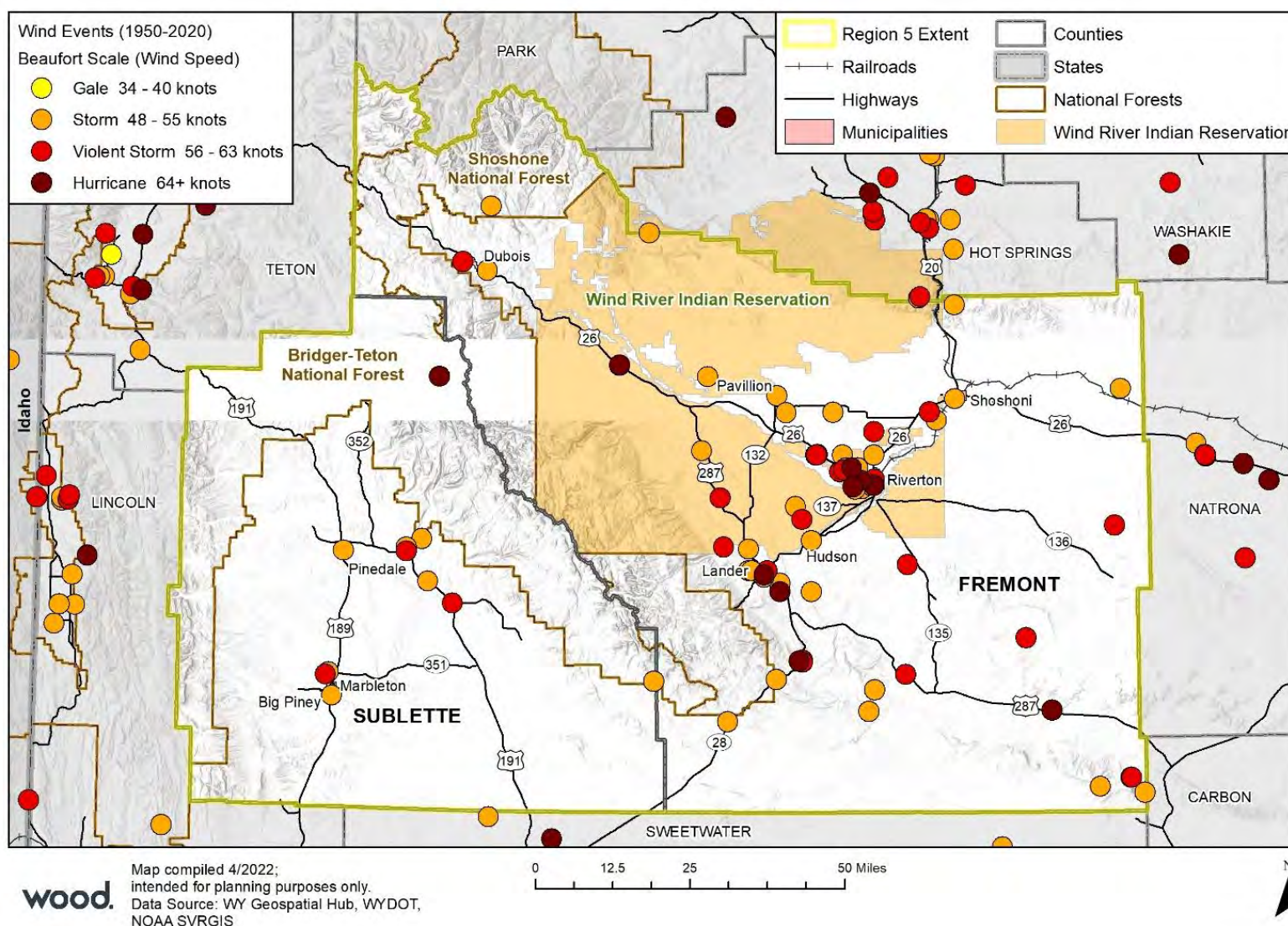


Source: T. Fujita

Geographical Area Affected

All areas of the Region can experience damaging wind events; therefore, the geographic area of tornadoes is ranked as **extensive**. The Fremont County HMPC specifically noted South Pass as an area that experiences significant wind. Figure 4-34 shows the various locations of historic wind events in Region 5.

Figure 4-34 Past Wind Events in Region 5



Past Occurrences

In the counties in Region 5, most documented wind events causing damage typically range between 58.5 and 72.4 mph; max wind speeds of up to 126.6 mph have been recorded. It should be noted that the data is limited by what the NCEI is able to record, and what equipment was in place at the time, and that the timespan of available records for each county and hazard differs. The county and tribal planning teams noted that high winds are a consistent issue in the region.

NCEI also records thunderstorm and high wind events differently. Thunderstorm wind events are recorded by county and there are records dating back to 1955. The first high wind event in the dataset was recorded in 1996 and these events are recorded on a zonal basis; while these zones show up in search results, they are not always tied to specific counties and tend to affect larger areas than thunderstorm wind events. When reviewing the NCEI data, most high wind events that impacted Sublette County also impacted Fremont County, however, Fremont County experienced a significant number of high wind events that did not impact Sublette County. The same can be said for thunderstorm wind events in the region.

NCEI records 340 total high wind events for Region 5, resulting in over 1.5 million dollars in property damages in just the past 25 years. Thunderstorm wind events in the region total to 128 with over \$800,000 in property damages. The NCEI reported a total of \$3,000 in crop damages in the region between both types of wind events. A United States Department of Agriculture (USDA) dataset was used to supplement the NCEI data and reported 14 different wind events in Fremont County since 2007, resulting in \$114,105 in crop damages and a total of 658.8 net acres of crops lost. The USDA had no reported crop losses for Sublette County. Table 4-48 and Table 4-49 provide a summary of the NCEI datasets for historic thunderstorm and high wind events in the region and Table 4-50 is a summary of the USDA crop loss dataset.

Table 4-48 Summary of Thunderstorm Wind Weather Events and Impacts

Region 5 Thunderstorm Wind Events (1955-2021)						
Total Number of Days with Wind Events	Total Property Damage	Total Crop Damage	Total Fatalities	Total Injuries	Average Recorded Wind Speed (mph)	Max Recorded Wind Speed (mph)
128	\$814,200.00	\$1,000.00	0	0	58.5	92.0
Fremont County (1964-2021)						
111	\$304,000.00	\$1,000.00	0	0	61.5	92.0
Sublette County (1983-2021)						
22	\$510,200.00	\$0.00	0	0	55.5	74.8

Source: NCEI

Table 4-49 Summary of High Wind Weather Events and Impacts

Region 5 High Wind Events (1996-2021)						
Total Number of Days with Wind Events	Total Property Damage	Total Crop Damage	Total Fatalities	Total Injuries	Average Recorded Wind Speed (mph)	Max Recorded Wind Speed (mph)
340	\$1,539,500.00	\$2,000.00	0	0	72.4	126.6
Zonal Incidents that Impacted Fremont County (1996-2021)						
339	\$1,009,500.00	\$2,000.00	0	0	71.7	126.6
Zonal Incidents that Impacted Sublette County (1996-2021)						
88	\$530,000.00	\$0.00	0	0	73.0	112.8

Source: NCEI

Table 4-50 Summary of Crop Damage from Wind Weather Events (USDA)

Region 5 Crop Loss Events (2007-2021)			
County Impacted	Total Number of Events	Total Crop Damage	Net Acres Lost
Fremont	14	\$114,105.00	658.8

Source: USDA

Damages recorded by the NCEI for the county include downed power lines, torn off roofs and building damage, and downed tree limbs and debris.

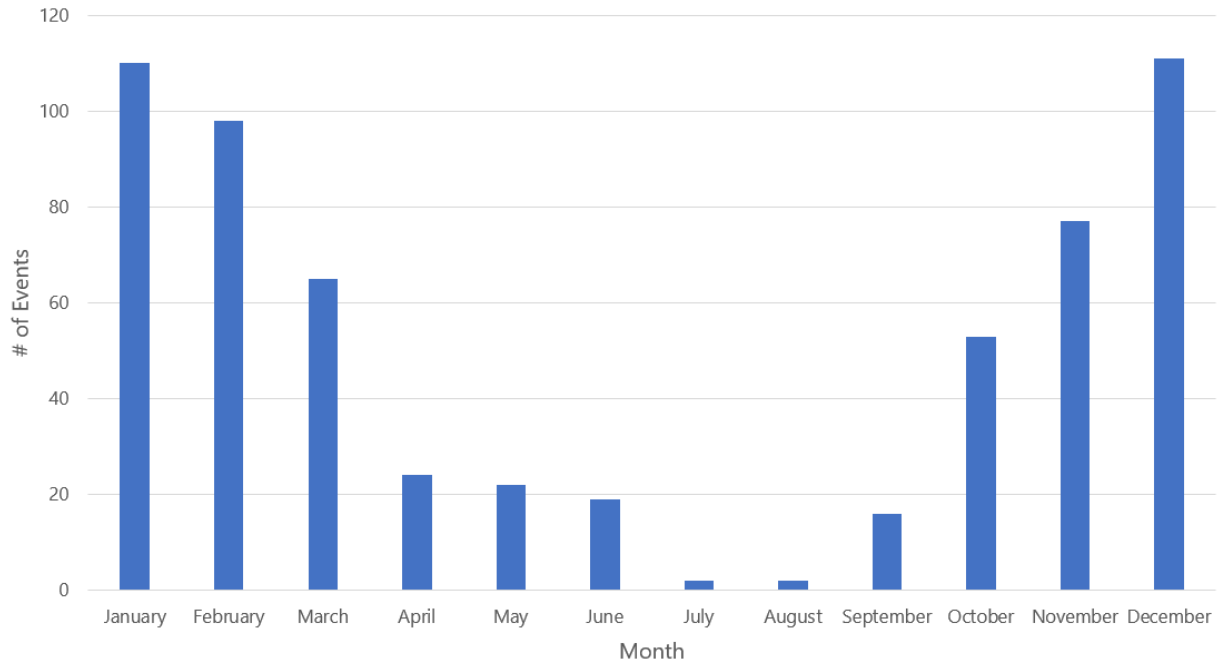
Specific examples from high wind incidents that caused damages documented by the NCEI include:

- **Fremont County, September 2013** - A 40x50 foot pole barn was ripped from its foundation and destroyed at a Missouri Valley ranch north of Riverton. Two nearby trees were toppled and blocked one lane of Paradise Valley Road. Damages totaled to \$50,000.
- **Fremont County (Morton), June 2009** - Measured wind gusts of 57 to 61 mph lifted a 16x40 foot metal structure which was staked to the ground and tossed it 60 to 70 feet downwind. Damages totaled to \$20,000.
- **Fremont County (Riverton) August 2007** - Outflow from nearby thunderstorms blew apart a 40 foot by 60-foot framed wooden structure under construction. The wind snapped support poles which were set in concrete. Damages totaled to \$10,000.
- **Fremont County (Lander) March 1999** - Official gust to 84 mph at the Lander airport; unofficial gusts to 141 mph and 107 mph in the foothills west of Lander. Considerable damage to trees, roofs, and automobiles in Lander and Ft. Washakie. Property damage amount is estimated. Gusts to 70 mph in the Casper area. Damages totaled to \$500,000.
- **Sublette County (Big Piney) July 1998** - High winds caused extensive damage to the High School roof. Damages totaled to \$400,000.
- **Sublette County (Big Piney) August 1999** - Scattered wind damage across Sublette County. Roof damage to Big Piney High School buildings. Power pole down near school. Tree damage in Big Piney and Marbleton. Power lines down 9 miles northeast of Big Piney. Power poles down near Pinedale. Damages totaled to \$63,000.
- **Sublette County (Pinedale) June 2005** - Thunderstorm winds estimated at 70 mph tore off a garage roof, blew down trees, and moved a camper off a trailer from Cora to Boulder. Power poles were also blown down leaving 740 customers without power for an hour. Damages totaled to \$40,200.

Frequency/Likelihood of Occurrence

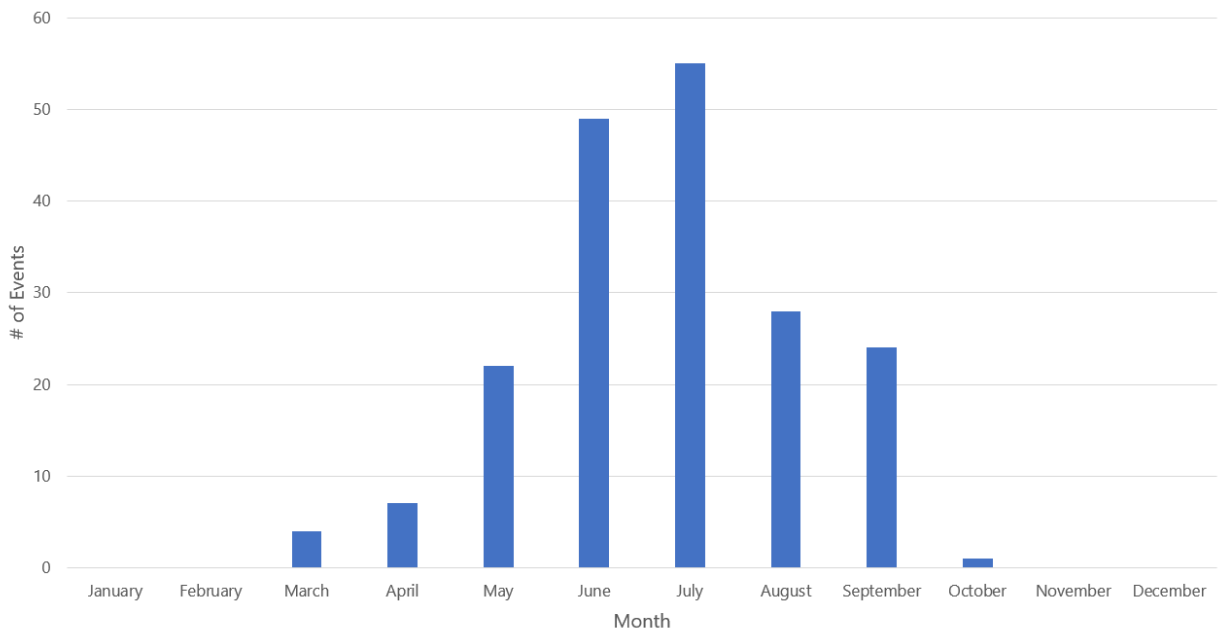
The NCEI Storm Events Database records 128 reported thunderstorm wind incidents and 340 high wind events impacting the Region since 1955. This data shows that the Region experiences an average of eight significant wind events per year, indicating that the region can expect multiple high wind incidents every year; therefore, the frequency of wind events in Region 5 is ranked as **highly likely**. Figure 4-35 and Figure 4-36 display historic wind events in Region 5. It is evident by these figures that high wind events are most likely to occur during the winter months in December, January, and February, peaking in December and thunderstorm wind events are more likely to occur during the summer months in June and July, with the greatest number of events in July. According to the best available data, Wyoming is likely to experience wind weather events all year long, with spikes in frequency of wind events in the summer and winter.

Figure 4-35 Region 5 Historic High Wind Events (Month)



Source: data provided by NCEI; illustration created by Wood

Figure 4-36 Region 5 Historic Thunderstorm Wind Events (Month)



Source: data provided by NCEI; illustration created by Wood

Changing Future Conditions

There presently is not enough data or research to quantify the magnitude of potential change that changing future conditions may have on windstorms. Future updates to the mitigation plan should include the latest research on how the windstorm hazard frequency and severity could change. The level of significance of this hazard should be revisited over time.

Potential Magnitude

High winds, often accompanying severe thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. Windstorms in the Region are rarely life threatening, but do disrupt daily activities, cause damage to buildings, and structures, and increase the potential for other hazards, such as wildfire; therefore, magnitude of wind is ranked as **limited**. Winter winds can also cause damage, close highways (blowing snow), and induce avalanches. Winds can also cause trees to fall, particularly those killed by pine beetles or wildfire, creating a hazard to property or those outdoors.

Damaging wind is measured using the Beaufort Wind Scale as shown in Table 4-51. This scale only reflects land-based effects and does not take into consideration the effects of wind over water. Winds up through Beaufort 12 can be experienced in the Region.

Table 4-51 Beaufort Wind Scale

Beaufort Number	Description	Windspeed (MPH)	Land Conditions
0	Calm	<1	Calm. Smoke rises vertically.
1	Light air	1 – 3	Wind motion visible in smoke.
2	Light breeze	3 – 7	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	8 – 12	Leaves and smaller twigs in constant motion.
4	Moderate breeze	13 – 17	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	18 – 24	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	25 – 30	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	31 – 38	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	39 – 46	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	47 – 54	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	55 – 63	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	64 – 72	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.

Beaufort Number	Description	Windspeed (MPH)	Land Conditions
12	Hurricane	≥ 73	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Source: National Oceanographic and Atmospheric Association

Vulnerability

People

Certain areas are more exposed due to geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out. It is not uncommon for residents living in more remote areas of the county to be isolated after such events.

Vulnerable populations are the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Based on the NCEI datasets, there were no injuries or fatalities in Region 5 due to high wind or thunderstorm wind events.

Property

All property is vulnerable during high wind events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Generally, damage is minimal and goes unreported. Property located at higher elevations and on ridges may be more prone to wind damage. Property located under or near overhead lines or near large trees may be damaged in the event of a collapse.

The NCEI reported several wind events in Region 5 that resulted in significant damages to structures, such as a barn ripped from its foundation on a farm north of Riverton and extensive damages to a high school roof in Sublette County. The costliest single wind event reported by NCEI was in Fremont County in 1999 when 84-141 mph winds resulted in considerable damages to trees, roofs, and cars near Lander, costing an estimated \$500,000 in damages.

Critical Facilities and Lifelines

High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating populations, and disrupting ingress and egress. Cascading hazards caused by high winds can result in power loss; depending on the time of year, winds can also exacerbate snow and blizzards by creating deep snow drifts over roads and affecting the normal flow of traffic. Wind can also disrupt daily activities for a significant time after an event, such as when facilities are damaged and need to undergo repairs.

Economy

Economic impacts of severe wind are typically short term. These events can disrupt travel into and out of all areas of the county and create perilous conditions for residents, tourists, and nature alike. Wind can also damage crops and impact the regional agricultural industry. A review of the USDA Risk Management Agency records shows between 2007 and 2021 the Region has had a total of \$114,105 indemnity payments for a total 658.8 acres lost to wind events. Additionally, the NCEI reported a total of \$2,353,700 in property damages in Region 5 between both types of wind events since 1955. Because state or presidential emergency or disaster declarations have not been necessary in the aftermath of wind events in the Region, and because damage to personal property is dealt with by numerous private insurance companies, it is difficult to estimate actual monetary impacts that have occurred due to damaging winds.

Environment and Cultural Resources

The environment is highly exposed to high winds. Environmental impacts include the downing of trees and localized flattening of plants by high wind. Natural habitats such as streams and trees risk major damage and destruction. Cultural resources such as historic buildings and landmarks that are not structurally sound could be more at risk for damage in high winds.

Development Trends

Historical data demonstrates that the most critical area in Wyoming for high wind hazards is the eastern one third of the state, which does not include Region 5. Nevertheless, Region 5 has historically experienced significant wind events and future residential or commercial buildings built to code should be able to withstand wind speeds of at least 150 miles per hour to minimize losses.

Risk Summary and Overall Significance by Jurisdiction

Many areas of the United States are prone to damaging wind events, and while the counties of Region 5 may not be counted in a high category for occurrences across the nation, it does have a history of such episodes which should be anticipated for the future. Primary damage is structural and utility borne. Although no deaths or injuries have been reported in Region 5, the frequency of events, as well as the hazard to rural citizens and town populations from falling trees, power poles, and flying debris.

Table 4-52 High Winds and Downbursts Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Extensive	Highly Likely	Limited	Medium
Sublette	Extensive	Highly Likely	Limited	Medium
Wind River Reservation	Extensive	Highly Likely	Limited	Medium

4.2.12 Landslide/Rockfall/Debris Flow

Hazard/Problem Description

A landslide is a general term for a variety of mass movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Landslides are a serious geologic hazard common to almost every state in the United States. It is estimated that nationally they cause up to \$2 billion in damages and from 25 to 50 deaths annually. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide include: saturation by water, erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions.

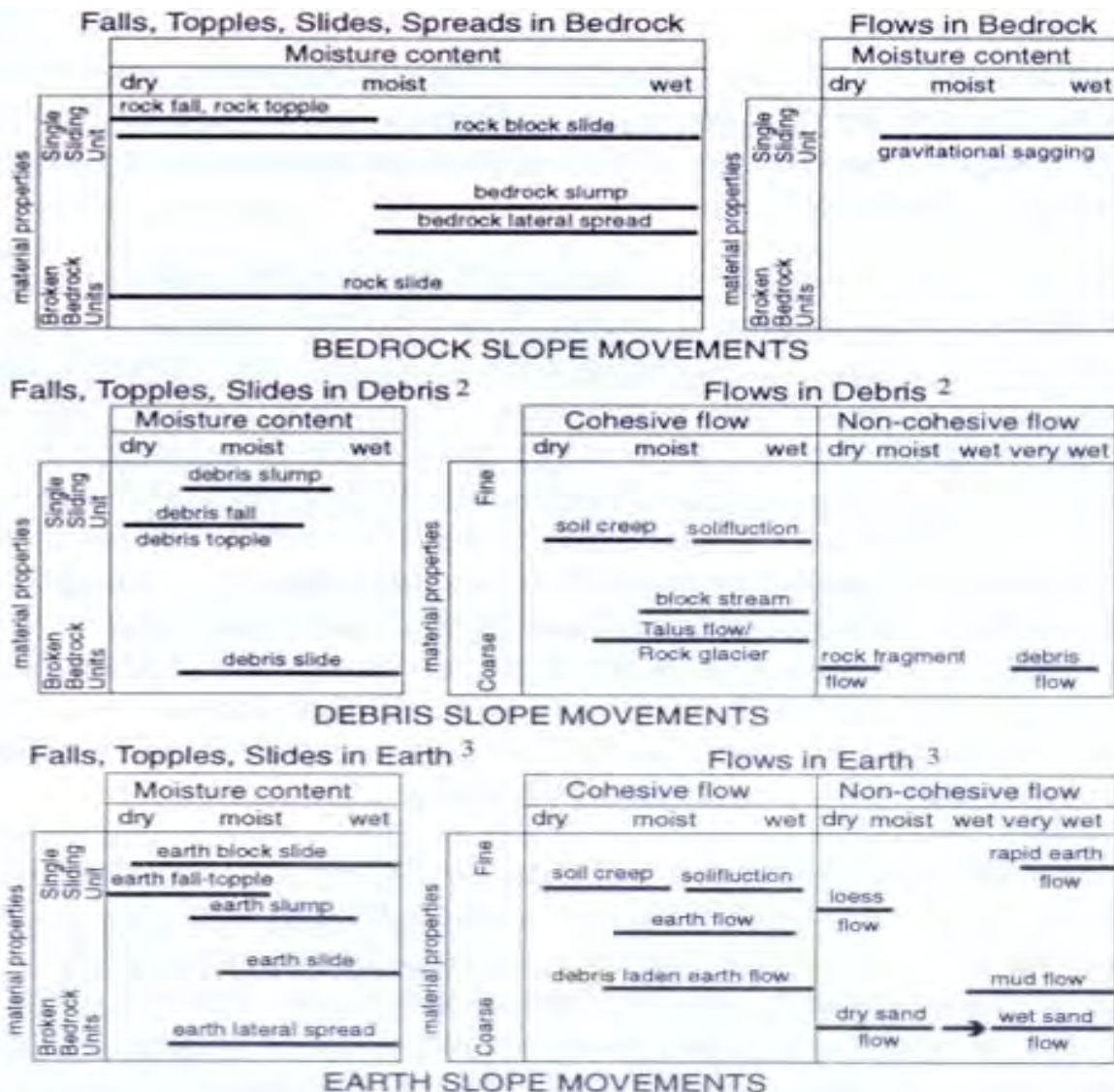
Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Generally significant landsliding follows periods of above-average precipitation over an extended period, followed by several days of intense rainfall. It is on these days of intense rainfall that slides are most likely.

Areas that are generally prone to landslide hazards include existing old landslides; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Landslides are often a secondary hazard related to other natural disasters. Landslide triggering rainstorms often produce damaging floods. Earthquakes often induce landslides that can cause additional damage.

Slope failures typically damage or destroy portions of roads and railroads, sewer and water lines, homes and public buildings, and other utility lines. Even small-scale landslides are expensive due to clean up costs that may include debris clearance from streets, drains, streams and reservoirs; new or renewed support for road and rail embankments and slopes; minor vehicle and building damage; personal injury; and livestock, timber, crop and fencing losses and damaged utility systems.

There are many types of landslides present in Wyoming. In order to properly describe landslide type, the Geologic Hazards Section developed a landslide classification modified from Varnes (1978) and Campbell (1985). As can be seen in Figure 4-37, there are five basic types of landslides that occur in three types of material. Falls, topples, slides, lateral spreads, and flows can occur in bedrock, debris, or earth. While individual landslide types can occur in nature, most landslides are complex, or composed of combinations of basic types of landslides.

Figure 4-37 Wyoming Landslide Classifications



¹ Classification modified from Varnes (1978) and Campbell (1985).

² Debris is defined as an engineering soil in which 20 to 80 percent of the fragments are larger than 2 millimeters (.08 inch).

³ Earth is defined as an engineering soil in which 80 percent of the fragments are smaller than 2 millimeters (.08 inch).

Wyoming State Geological Survey
Geologic Hazards Section, Jan., 1998

Rockfall

A rockfall is the falling of a detached mass of rock from a cliff or down a very steep slope. Weathering and decomposition of geological materials produce conditions favorable to rockfalls. Rockfalls are caused by the loss of support from underneath through erosion or triggered by ice wedging, root growth, or ground shaking. Changes to an area or slope such as cutting and filling activities can also increase the risk of a rockfall. Rocks in a rockfall can be of any dimension, from the size of baseballs to houses. Rockfall occurs most frequently in mountains or other steep areas during the early spring when there is abundant moisture

and repeated freezing and thawing. Rockfalls are a serious geological hazard that can threaten human life, impact transportation corridors and communication systems, and result in other property damage.

Spring is typically the landslide/rockfall season in Wyoming as snow melts and saturates soils and temperatures enter into freeze/thaw cycles. Rockfall and landslides are influenced by seasonal patterns, precipitation and temperature patterns. Earthquakes could trigger rockfalls and landslides too.

Debris Flow

Debris flows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are common types of fast-moving landslides. They are a combination of fast-moving water and a great volume of sediment and debris that surges down slope with tremendous force. These flows generally occur during periods of intense rainfall or rapid snowmelt and may occur with little onset warning, similar to a flash flood. They usually start on steep hillsides as shallow landslides that liquefy and accelerate to speeds that are typically about 10 miles per hour but can exceed 35 miles per hour. Figure 4-38 describes identifying characteristics of debris flows. The consistency of debris flow ranges from watery mud to thick, rocky mud that can carry large items such as boulders, trees, and cars. Debris flows from many different sources can combine in channels, and their destructive power may be greatly increased. When the flows reach flatter ground, the debris spreads over a broad area, sometimes accumulating in thick deposits that can wreak havoc in developed areas. Mudflows are covered under the National Flood Insurance Program; however, landslides are not.

Figure 4-38 Field Evidence of Debris Flow



Geographical Area Affected

Landslides are one of the most common geologic hazards in Wyoming. Figure 4-39 below shows mapped landslides in the Region. Note the relatively high concentration of landslide deposits in the northwestern portion of Fremont County. Many of these slide areas have been studied by the WSGS, WYDOT and others.

Fremont County Landslide Areas

In Fremont County, the primary area of concern is along Highway US-26/287. Hwy 26 is the most direct route for accessing the Grand Teton National Park from central and southeastern Wyoming. In 2005, WYDOT identified a 21-mile segment along the roadway between Moran Junction and Dubois that was in need of major roadway improvements. Approximately 20 landslides were also observed within the outlined

segment. WYDOT conducted subsurface investigations and designed roadway improvement measures that were to be constructed from 2006 through 2010. Landslide Technology was retained to assist with geologic reconnaissance and interpretations, evaluate landslide features, review potential slope instability, and develop conceptual-level landslide mitigation measures.

For a complete list of quadrangles in Fremont County with a history of landslides refer to the County Annex.

Sublette County Landslide Areas

In Sublette County, the area of concern is along Highway 191 near Bondurant.

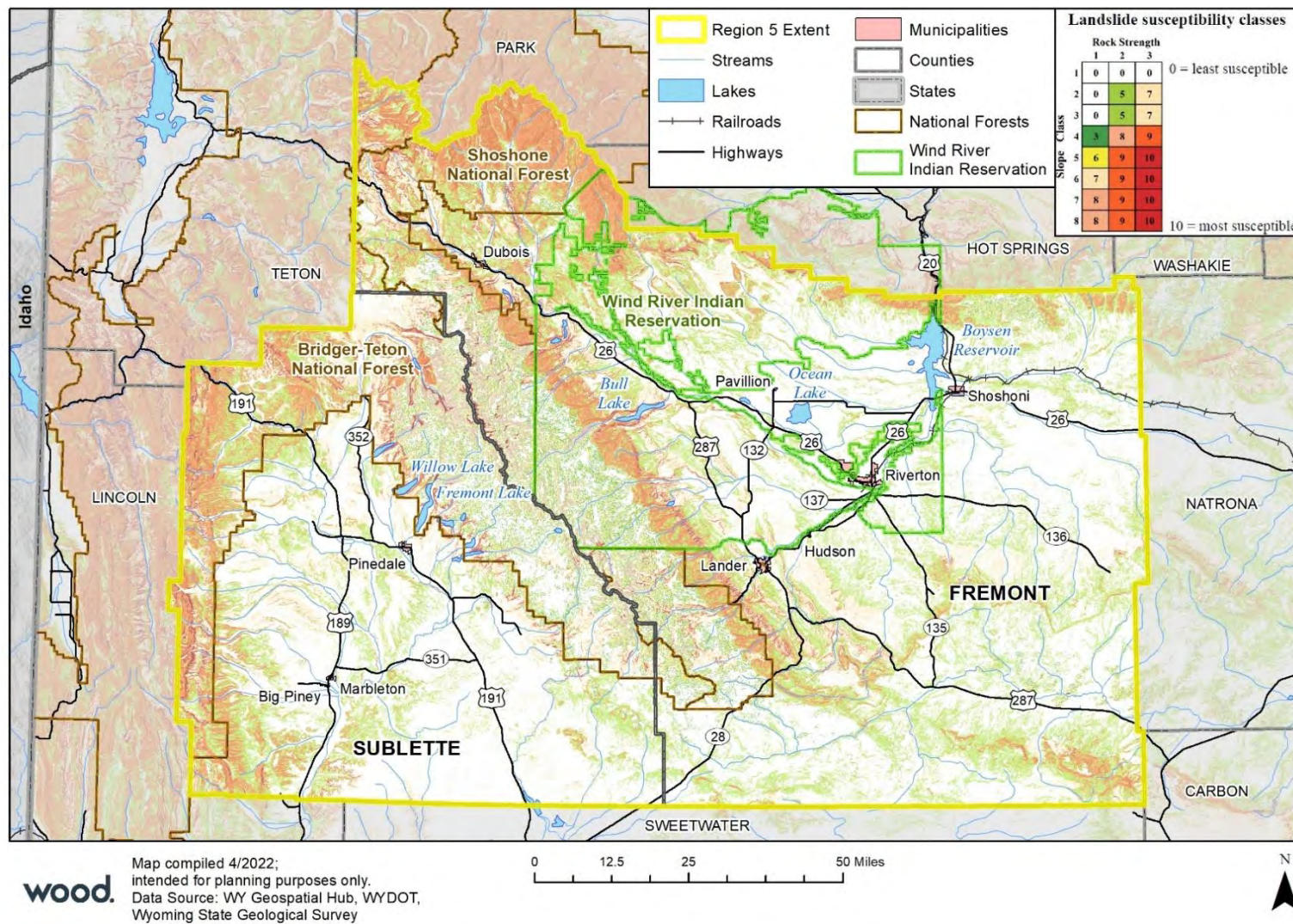
Bondurant is at the confluence of the Hoback River and its South Fork and within the Gros Ventre Wilderness. The highway cuts through the mountains and is surrounded by steep cliffs on either side. Landslides in Teton County along Highway 191 can also impact the flow of traffic and goods into Sublette County.

The HMPC noted that Stewart Point south of Pinedale has evidence of landslides. A USFS representative noted that many Forest Service roads are at risk in Sublette County. For a complete list of quadrangles in Sublette County with a history of landslides refer to the County Annex.

The HMPC also noted in 2022 that, as the Town of Pinedale in Sublette County has grown, the risk of landslides along the eastern hillside of the municipality has increased. Saturated granitic soils from upland irrigation, subdivision septic system percolation and storm water run-off have charged the hillside seeps into measurable quantities of discharge. The sloughs and scarps are more evident and will continue to increase as the Town grows.

Rio Verde Engineering, Jorgenson Engineering and Nelson Engineering have all done geotechnical surveys and bore sampling which confirm the glaciation formation and the subsequent scarps that have ensued from these water sources. The current locations are: 1) the Orcutt Hill Seep in Shelter Park that carries hundreds of gallons to the Town of Pinedale sewer system during the fall, winter and spring when the Pine Creek Canal No. 1 head gate is closed, 2) the hillside seeps that exist from the Shelter Park Bridge to the Fremont Lake Road bridge, 3) the storm-water drainage from the Clinic & Museum, Skyline Apartments and Burzlander Park and 4) the most recent hillside scarp on the Delgado Property south of the Town of Pinedale.

Figure 4-39 Region 5 Landslide Areas



Past Occurrences

Landslides, debris flows, and rockfalls occur regularly in Wyoming and the Region, though limited information was available on previous occurrences that caused a particular high amount of damage or incurred some other cost or unique impact.

On July 22, 2011, President Obama declared a major disaster for the State of Wyoming for emergency work and the repair or replacement of facilities damaged by the severe storms, flooding, and landslides in Albany, Big Horn, Carbon, Crook, Fremont, Goshen, Johnson, Lincoln, Platte, Sheridan, Sublette, Teton, Uinta, Washakie, and Weston Counties, and the Wind River Indian Reservation. This declaration made Public Assistance funding available.

The Wind River Canyon in Hot Springs County, which also includes the Wind River Reservation, has been impacted by several landslide, debris flow and rockfall events over the years. Members of the HMPC noted many debris flow incidents in Wind River Canyon located in the Wind River Reservation following heavy rains in May 2015, which impacted the railroad. According to the State Hazard Mitigation Plan, in July 1937, landslides took out several sections of highway and railroad. In all, highways suffered damage in 12 counties. Severe damage occurred in the Upper Big Horn Basin. There were more than 3,000 feet of railway washed out and much was covered by landslides. The highway was badly damaged from Riverton to Thermopolis and traffic was suspended temporarily. Near Shoshoni, travel was only possible by long detours. Highways were considerably damaged in ten other counties in the eastern half of the state. (Source: State of Wyoming Multi-Hazard Mitigation Plan)

In Fremont County, a USFS representative on the planning committee noted that many Forest Service roads are at risk to landslides. The HMPC reported debris flows on Sinks Canyon Rd/131 in Sinks Canyon and at WyPo Corner following the 2016 flooding.

Frequency/Likelihood of Occurrence

The probability of a landslide causing damage in the Region is difficult to determine because of the poor historic data. However, given it is reasonable to assume that damaging events have between 10 and 100 percent chance of occurrence in the next year, or a recurrence interval of 10 years or less. Therefore, landslides, rockfalls or debris flows are likely to occur. Heavy periods of precipitation or significant development could have an effect on slope stability. Typically, there is a landslide/rockfall 'season' that coincides with increased freeze-thaw cycles and wetter weather in the spring and early summer.

Changing Future Conditions

Winter and spring precipitation are projected to increase for Wyoming (NOAA 2016). In addition, increased temperatures are projected to contribute to more water evaporation making drought more common, which would increase the probability of wildfire, reducing the vegetation that helps to support steep slopes. Wildfires and earthquakes destabilize soil on steep slopes increasing landslide and debris flow risk. Erosion caused by development on steep hillsides increases risk of landslides.

Potential Magnitude (Extent)

There are three measures of future landslide impacts – historic dollar damages, estimated yearly damages, and building exposure values. There is not enough current data to estimate historic or yearly dollar damages. In general terms, landslides can threaten human life, impact transportation corridors and communication systems, and cause damage to property and other infrastructure. Actual losses can range from mere inconvenience to high maintenance costs where very slow or small-scale destructive slides are involved. The potential magnitude of landslides, rockfall and debris flows would typically be isolated in most counties in the region. However, even a small, isolated event has potential to close state or US highways in

the region that can result in long detours for days or weeks. With the added cost of detours, and the potential for life safety impacts, some landslides could have greater costs.

Vulnerability Assessment

People

The overall vulnerability of population is low. The general population is not overly vulnerable to landslides, but rockfall can cause serious injury or death. There are areas prone to rockfall on Highway 191 near Bondurant and on Highway 26 between Moran and Dubois.

According to GIS analysis updated during the 2022 planning process there are an estimated 27,590 residents potentially exposed to landslide-susceptible hazard areas. The Wind River Reservation has the greatest number, 9,929, of residents exposed. Table 4-53 summarizes the population exposure for the counties in the Region and Table 4-54 summarizes population exposure for the Wind River Reservation .

Table 4-53 Estimated Population Exposed to Landslide Hazards Areas in Fremont and Sublette Counties

Jurisdiction	Population
Fremont County	8,536
Sublette County	9,125
Total	27,590

Source: WYGS Landslide susceptibility data, Wyoming CAMA 2021, Wood GIS Analysis

Table 4-54 Estimated Population Exposed to Landslide Hazard Areas in the Wind River Reservation

Landslide Susceptibility	Population
Highest	179
Moderately High	541
Moderate	421
Least	8,788
Total	9,929

Source: WYGS Landslide susceptibility data, Wind River Indian Reservation, Wyoming CAMA 2021, Wood GIS Analysis

Property

During the 2022 development of this regional plan a GIS analysis of exposure to landslide hazard areas was performed. Table 4-55 and Table 4-56 summarizes landslide exposure in the county, based on an intersect of improved parcels with landslide hazard areas. This analysis does not necessarily mean these properties are at imminent risk, but it does indicate potential exposure to damage. More site-specific investigations would be needed to determine risk. The greatest potential exposure to risk for general property is in Fremont County.

Table 4-55 Landslide Exposure by County and Jurisdiction

County	Jurisdiction	Parcel Count Highest	Parcel Count Moderately High	Parcel Count Moderate	Total Parcel Count	Improved Value	Estimated Content Value	Total Value
Fremont	Dubois	51	96	130	277	\$64,259,794	\$36,855,684	\$101,115,478
	Hudson	-	20	10	30	\$2,686,103	\$1,531,190	\$4,217,293
	Lander	-	240	108	348	\$75,246,292	\$43,667,401	\$118,913,693
	Pavillion	-	-	-	-	-	-	-
	Riverton	3	49	117	169	\$44,603,802	\$23,226,230	\$67,830,032
	Shoshoni	-	-	4	4	\$30,957	\$27,353	\$58,310
	Fremont Unincorp.	537	970	1,159	2,666	\$506,523,200	\$263,223,923	\$769,747,123
	Total	591	1,375	1,528	3,494	\$693,350,148	\$368,531,779	\$1,061,881,927
Sublette	Big Piney	-	-	-	-	-	-	-
	Marbleton	-	5	-	5	\$452,063	\$226,032	\$678,095
	Pinedale	-	41	-	41	\$16,065,805	\$8,278,778	\$24,344,583
	Sublette Unincorp.	200	721	2,687	3,608	\$648,512,602	\$341,036,543	\$989,549,145
	Total	200	767	2,687	3,654	\$665,030,470	\$349,541,353	\$1,014,571,823
Grand Total		791	2,142	4,215	7,148	\$1,358,380,618	\$718,073,132	\$2,076,453,750

Source: WYGS Landslide susceptibility data, Wind River Indian Reservation, Wyoming CAMA 2021, Wood GIS Analysis

Table 4-56 Landslide Exposure on Wind River Reservation

Land Susceptibility	Improved Parcels	Building Counts	Improved Value	Est. Content Value	Total Exposure	Population
Highest	34	69	\$2,996,141	\$1,617,155	\$4,613,296	179
Moderately High	64	208	\$7,861,210	\$4,031,151	\$11,892,361	541
Moderate	62	162	\$5,249,901	\$2,704,460	\$7,954,361	421
Least	682	3,380	\$92,028,603	\$54,460,791	\$146,489,394	8,788
Total	842	3,819	\$108,135,855	\$62,813,557	\$170,949,412	9,929

Source: WYGS Landslide susceptibility data, Wind River Indian Reservation, Wyoming CAMA 2021, Wood GIS Analysis

Critical Facilities and Lifelines

Transportation networks are the most exposed aspect of the Region to rockfall, landslide and debris flow incidents. Residents and visitors alike are impacted by landslides when roads are damaged by landslides. This includes Highway 26/287 in Fremont County and Highway 191 in Sublette County. The loss of transportation networks could potentially cause secondary damage to the overall Region's infrastructure, including revenue, transportation availability, emergency response mechanisms and other essential capabilities by preventing the means of these resources from activating or moving between locations. Table 4-57 summarizes the results of the GIS analysis.

Table 4-57 Critical Facilities within Landslide Hazard Areas

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Safety and Security	Transportation	Total
Highest Susceptibility								
Fremont	Unincorporated	28	5	-	-	-	-	2
	Total	28	5	0	0	0	0	2
Sublette	Unincorporated	69	-	-	-	-	-	2
	Total	69	0	0	0	0	0	2
Wind River Reservation	Total	15	-	-	-	-	-	15
Grand Total		112	5	0	0	0	0	19
Moderately High Susceptibility								
Fremont	Dubois	-	-	-	-	-	-	1
	Hudson	-	1	-	-	-	-	-
	Lander	-	1	-	-	1	-	-
	Riverton	7	-	-	-	-	-	-
	Unincorporated	20	1	-	-	-	-	18
	Total	27	3	0	0	1	0	19
Sublette	Big Piney	-	-	-	-	-	1	-
	Unincorporated	19	1	-	-	-	-	14
	Total	19	1	0	0	0	1	14
Wind River Reservation	Total	5	-	-	-	-	2	7
Grand Total		51	4	0	0	1	3	40
Moderate Susceptibility								
Fremont	Lander	-	-	-	-	-	1	-
	Riverton	32	-	-	-	-	-	-
	Unincorporated	91	5	-	1	-	4	10
	Total	123	5	0	1	0	5	10
Sublette	Unincorporated	104	1	-	1	-	-	3
	Total	104	1	0	1	0	0	3
Wind River Reservation	Total	45	1	-	-	1	1	48
Grand Total		272	7	0	2	1	6	61

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Safety and Security	Transportation	Total
Least Susceptibility								
Fremont	Dubois	2	1	-	-	1	7	6
	Hudson	-	-	-	-	-	1	1
	Lander	23	-	-	-	3	23	5
	Pavillion	5	-	-	-	-	5	-
	Riverton	46	3	4	-	6	29	8
	Shoshoni	2	-	-	-	-	5	-
	Unincorporated	337	60	1	7	1	28	129
	Total	415	64	5	7	11	98	149
Sublette	Big Piney	7	1	1	-	-	4	1
	Marbleton	23	-	-	-	-	1	1
	Pinedale	30	-	-	-	1	15	4
	Unincorporated	189	5	-	5	-	6	78
	Total	249	6	1	5	1	26	84
Wind River Reservation	Total	36	14	-	2	12	42	107
Grand Total		700	70	6	12	12	124	233
Grand Total		1,034	85	6	14	13	130	283

Source: WYGS Landslide susceptibility data, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Economy

Economic impacts typically center around transportation routes temporarily closed by rockfall, debris flow, mudflow, or landslide activity. These roads may be used to transport goods across the county or provide access by visitors and tourists. Depending on the amount of damage, the road may simply need to be cleaned off, or may need some level of reconstruction and affect the local economy indirectly.

Environmental and Cultural Resources

The environment vulnerable to landslide hazard is the same as the environment exposed to the hazard. While typically a natural process, some environmental problems can result from mass movements. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods of time.

Development Trends

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Landslide areas tend to be picturesque and often within mountainous locations and therefore attract development. Development in landslide areas frequently consists of vacation homes and represents a potential risk for injury, loss of life and property. See also the discussion on landslides and development around Pinedale in the Geographical Area Affected section.

Risk Summary and Overall Significance by Jurisdiction

Overall, landslides, rockfalls and debris flows range from low to high significance hazards in the region. Landslides have the potential for direct property impacts including residential structures but more likely infrastructure corridors including roads and highways, power line corridors, and gas lines.

Table 4-58 Landslide Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Limited	Likely	Limited	Medium
Sublette	Limited	Likely	Limited	Medium
Wind River Reservation	Limited	Likely	Limited	Medium

4.2.13 Lightning

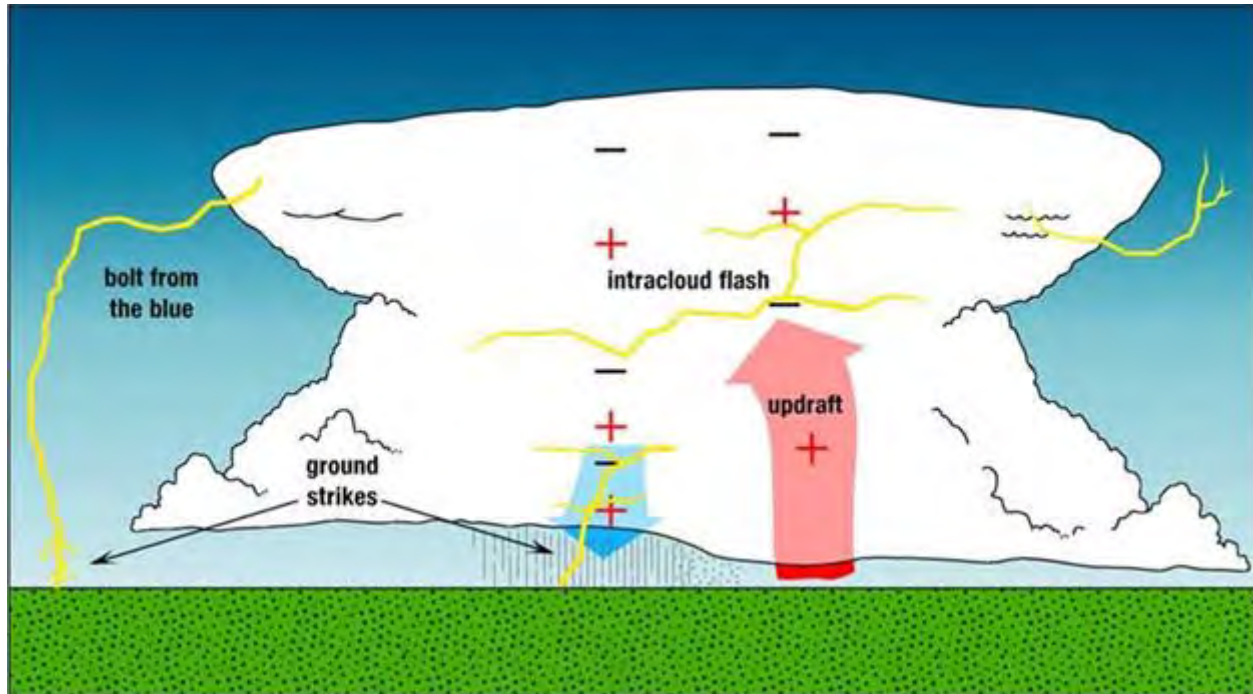
Hazard/Problem Description

Lightning is a sudden electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four strokes per flash. The length and duration of each lightning stroke vary, but typically average about 30 microseconds. Lightning's unpredictable nature causes it to be one of the most feared weather elements.

Lightning follows a course from cloud-to-ground, cloud-to-cloud, or cloud to surrounding air, with light illuminating its path. Figure 4-40 depicts cloud-to-ground lightning, which is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, some of these flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead of or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning

also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 4-40 Cloud-to-Ground Lightning

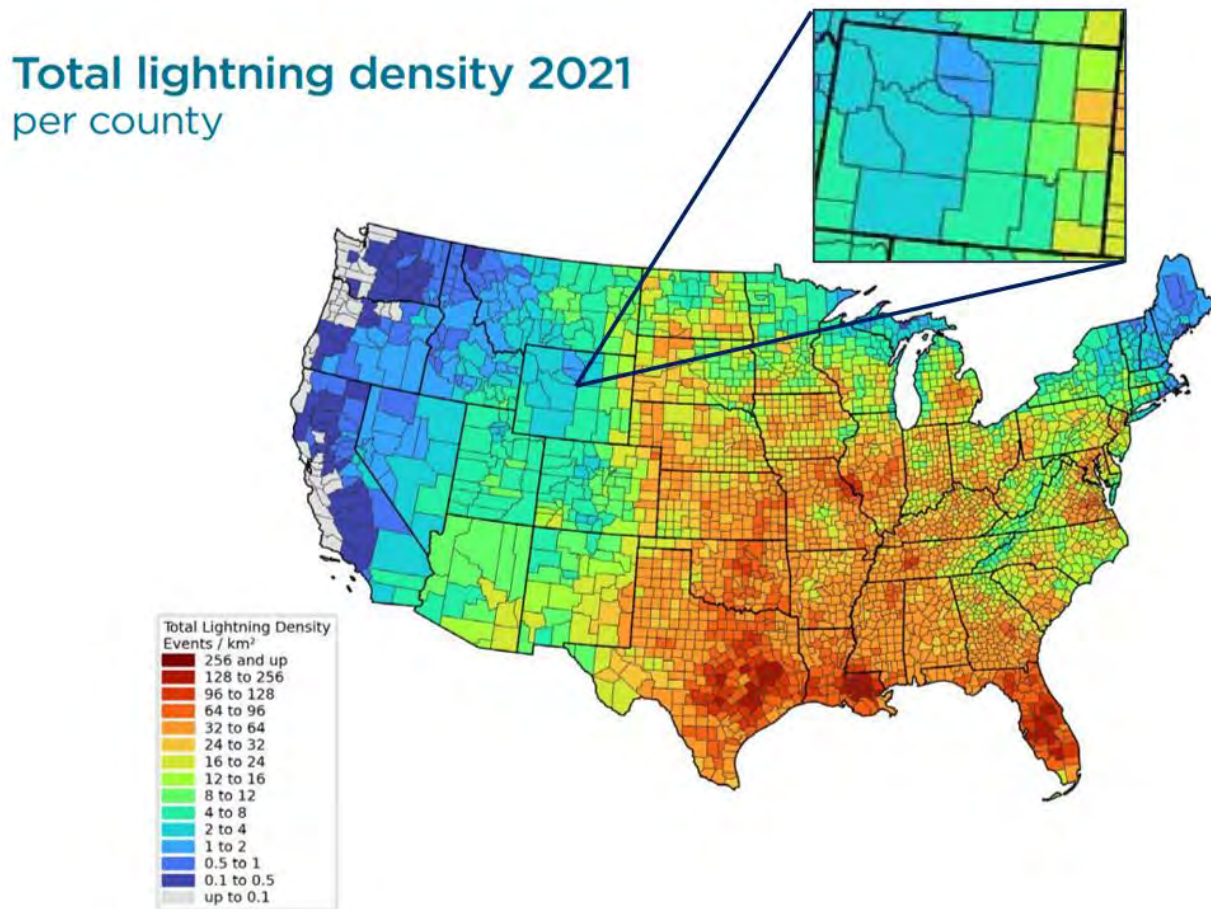


Source: National Weather Service

Geographical Area Affected

All of Region 5 is susceptible to lightning impacts, particularly the higher elevation mountainous areas; therefore, the geographic area of lightning is ranked as **extensive**. Nationwide lightning strikes are routinely monitored by Vaisala, Inc. with accuracies to within a 1-kilometer resolution. In 2021, there were 1,563,326 lightning counts in Wyoming. Figure 4-41 shows the total lightning density in the U.S. in 2021. These values can vary by 50 percent in a year depending on whether there is a drought or enhanced monsoonal flow. However, the locations of maximum and minimum strikes do not change much from year to year.

Figure 4-41 U.S. Total Lightning Density 2021 by County



Source: Vaisala Lightning Report 2021

Past Occurrences

Nationally, Wyoming ranks 36th in number of lightning fatalities, 33rd in injuries, and 40th in property damage from 1959 to 1994 according to the National Oceanic and Atmospheric Administration, National Severe Storms Laboratory (NOAA, NSSL). Wyoming is number one in the nation in lightning deaths per capita according to the National Weather Service. According to the NCEI Storm Events Database, lightning has been responsible for 1 death, 6 injuries, \$243,000 in property damage, and \$82,000 in crop damage in Wyoming Region 5 between 1996 and 2021. The NCEI records lightning incidents that have some sort of measurable impact; Table 4-59 includes all lightning incidents recorded by the NCEI in Region 5.

Table 4-59 Region 5 Lightning History 1996–2021

County	Location	Date	Fatalities	Injuries	Property Damage	Crop Damage
Sublette	Pinedale	6/8/2001	0	4	\$0	\$0
Sublette	Pinedale	6/16/2003	1	1	\$0	\$0
Sublette	(BPI) Big Piney APRT	6/10/2009	0	0	\$3,000	\$0
Sublette	Cora	5/18/2010	0	0	\$0	\$42,000

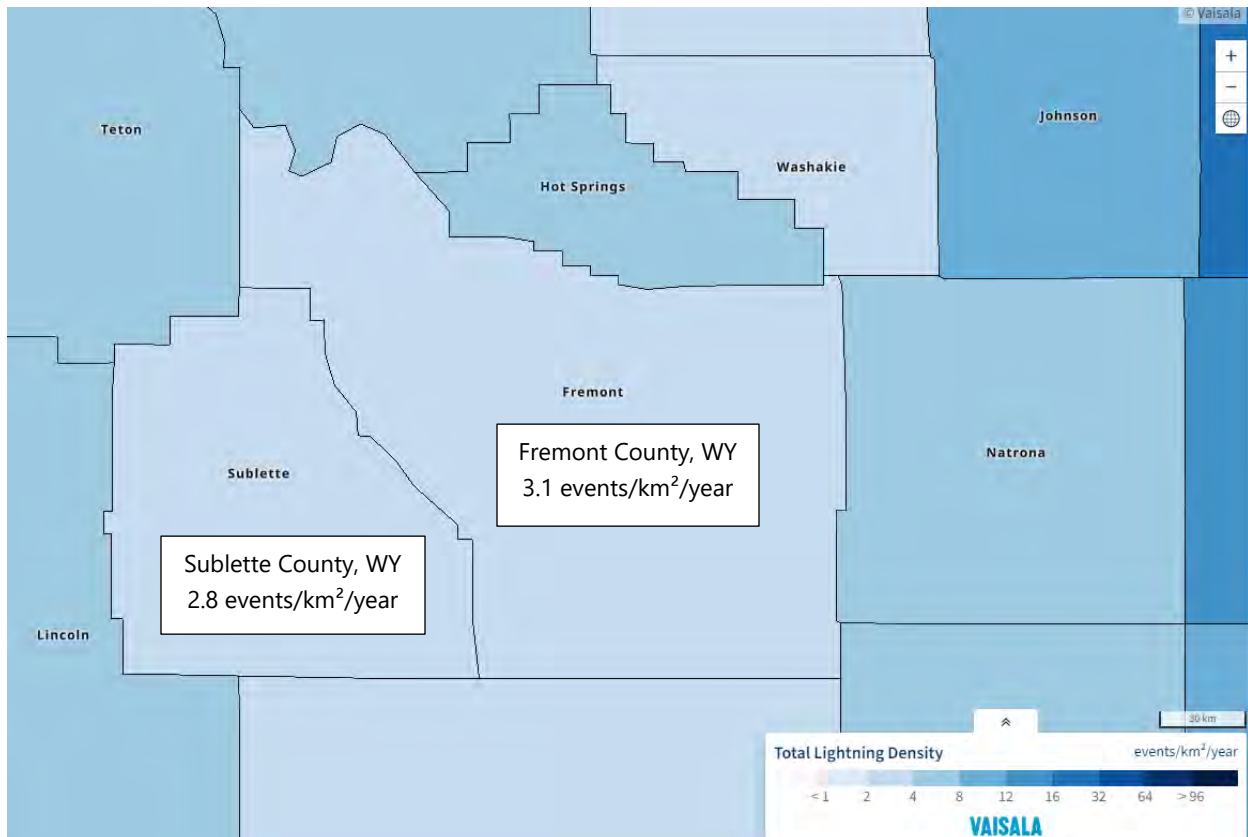
County	Location	Date	Fatalities	Injuries	Property Damage	Crop Damage
Fremont	Sand Draw	7/2/2009	0	0	\$40,000	\$0
Fremont	Midvale	8/6/2010	0	0	\$0	\$40,000
Fremont	Riverton	6/13/2011	0	0	\$200,000	\$0
Fremont	Milford	6/4/2012	0	1	\$0	\$0
Totals			1	6	\$243,000	\$82,000

Source: NCEI, 1996-2021

Frequency/Likelihood of Occurrence

The Region 5 annual lightning strike frequency from 2016-2021 is depicted in Figure 4-42. The Region's flash density is relatively low, ranging from 2 to 4 flashes per kilometer per year. Despite annual variation, the locations of maximum and minimum strikes do not change much from year to year. This data suggests that Region 5 can expect numerous lightning events each year; therefore, frequency of lightning events is ranked as **highly likely**.

Figure 4-42 Average annual lightning flash density (flashes/sq. mi./year) 2016-2021



Source: Illustration courtesy of Vaisala Inc.

Changing Future Conditions

As the atmosphere warms further due to climate change, the increased heat in the atmosphere provides more energy for severe storms. The frequency of severe weather events has increased steadily over the last century. Historical data shows that the probability for severe weather events increases in a warmer climate.

The changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. All these impacts could have significant economic consequences.

A warming climate may also affect the frequency of lighting; in 2014 researchers at the University of Berkeley conducted a study that found that for every one-degree Celsius rise in the average global temperature, there will be a 12 percent increase in the amount of lightning strikes. Vaisala also reported that there was a 91% increase in lighting detected in the North Pole and a significant increase in overall lightning events across the U.S., with 24 million more events in 2021 than 2020.

Potential Magnitude

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the National Weather Service to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. Due to the high elevation and varied topography of the Region, the counties in Region 5 are at risk to experience lightning in any of these categories. The LAL is reproduced in Table 4-60.

Table 4-60 Lightning Activity Level of Scale

Lightning Activity Level	
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud-to-ground strikes in a five-minute period
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud-to-ground strikes in a five-minute period.
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud-to-ground strikes in a five-minute period.
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud-to-ground strikes in a five-minute period.
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning.

Source: National Weather Service

Lightning can cause deaths, injuries, and property damage, including damage to buildings, communications systems, power lines, and electrical systems. It also causes forest, brush, and structural fires. Damage from lightning occurs in four ways:

- Electrocution, severe electrical shock, and burns of humans and animals
- Vaporization of materials in the path of the strike
- Fire caused by the high temperatures associated with lightning
- Power surges that can damage electrical and electronic equipment

When people are struck by lightning, the result is deep burns at the point of contact (usually on the head, neck, and shoulders). Approximately 70 percent of lightning survivors experience residual effects such as vision and hearing loss or neuropsychiatric issues. These effects may develop slowly and only become apparent much later. According to the CDC, death occurs in around 10 percent of lightning strike victims. An average of 35 people die from lightning strikes each year.

Lightning strikes cause intense but localized damage. In contrast to other hazards, lightning does not cause widespread disruptions within the community. Structural fires, localized damage to buildings, damage to electronics and electrical appliances, and electrical power and communications outages are typical consequences of a lightning strike. Additionally, indirect fatalities may result via electrocution when a person steps from a vehicle into standing water that was previously “charged” by a live powerline that was knocked loose by a lightning strike.

The indirect social and economic impacts of lightning damage are typically associated with the loss of electrical power. Since society relies heavily on electric power, any disruption in the supply, even for a short period, can have significant consequences. Wildfires can also be an indirect result of a lightning strike.

Past events in Region 5 indicate that the potential magnitude of lightning events will likely be **limited**, with isolated deaths and/or injuries and illnesses may occur; major or long-term property damage that threatens structural stability due to structural damage or fires; and/or interruption of essential facilities and services for 24-72 hours due to structural damage or utility outages.

Vulnerability Assessment

People

Anyone that is caught in an exposed area during a thunderstorm could be at risk of getting struck by lightning. In Wyoming, outdoor enthusiasts venturing to high and exposed areas should be especially cautious because rapid thunderstorm development with associated lightning can place even the most experienced persons in jeopardy without warning. Nationwide, 85 percent of lightning victims are children and young men ages 10-35 engaged in outdoor recreation or work. Outdoor recreation is a major economic contributor to Region 5. People may often find themselves outside and need to be especially watchful of the weather during the summer months when afternoon thunderstorms are more common. U.S. statistics show that one in 345,000 lightning flashes results in a death and one in 114,000 results in an injury nationwide. According to meteorologists at Vaisala, Inc., the odds for an American being hit by lightning sometime in an 80-year lifespan is about 1 in 3,000.

Members of the population who rely on constant, uninterrupted electrical supplies may have a greater, indirect vulnerability to lightning. As a group, the elderly or disabled, especially those with home health care services, rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes, Community Based Residential Facilities, or other special needs housing may also be vulnerable if electrical outages are prolonged and there is no available back-up power source. For all these populations, there are also concerns regarding these individual's dependence on caretakers, which increases their vulnerability during disaster events such as a power outage. Rural residents and agricultural operations reliant on electricity for heating, cooling, and water supplies are also especially vulnerable to power outages.

According to NCEI data, lightning caused one fatality and six recorded injuries between 1996-2021 in Region 5; these injuries were to people caught unprotected during a lightning storm. The 2003 Pinedale lightning event killed one hiker and injured another. The two were first struck while on the hike and decided to stop walking and wait for the storm to pass. While waiting, they were struck again, and one hiker did not survive. In 2012, a 25-year-old man was struck by lightning while working outside on wet ground. The man was hospitalized for 3 days but survived, however, the man reported experiencing chest pain, blurry eyesight, and pain in his arms and legs.

Property

Most reported damages from lightning are fires to private structures, damage to chimneys or steeples, or small grass fires. Property is more vulnerable to lightning than population because of the exposure ratios; while people can take shelter indoors, buildings remain exposed. Mitigation techniques such as choice of

building materials or landscaping help reduce the vulnerability of these properties, but there is no data available to segment these properties out of the overall vulnerability assessment.

According to the event details collected in the NCEI database, lightning has resulted in \$243,000 in property damages in Region 5. Several incidents of property damage were described in detail in the NCEI data. In June of 2009, lightning struck a water tank in southern Sublette County and resulted in \$3,000 in damages. In July of 2009, lightning struck almost 15 miles southeast of Riverton and hit four tanks, resulting in two explosions and all tanks rupturing. The contents of the tanks were spilled on the ground and damages totaled to \$40,000. The most significant loss due to lightning occurred in June of 2011, when lightning struck a home and sparked a fire. There were no fatalities or injuries, however, the entire home was destroyed and cost \$200,000 in damages.

In addition to property damages, the NCEI reported \$82,000 in crop damages due to lightning. In May of 2010, a lightning strike ignited a haystack near Cora, resulting in a fire that scorched 350 tons of hay and cost \$42,000 in losses. A similar incident occurred in August of 2010, when lightning caused a fire in a 400-ton stack of hay. The hay smoldered for several days before igniting in flames. Despite the efforts of fire response personnel, the entire stack, worth \$40,000, was lost. The HMPC also noted that lightning has killed livestock in Fremont County.

Critical Facilities and Lifelines

Some essential infrastructures and facilities can be impacted by lightning. Emergency responders, hospitals, government services, schools, and other important community assets are similarly vulnerable to lightning as the general vulnerabilities established for property and population. Some aspects of infrastructure are constructed of materials and/or located in places that increase their vulnerability to lightning. Sometimes, communications and infrastructure are interrupted by lightning strikes. These events raise the vulnerability of the essential functions by delaying response times, hindering interagency communication efforts, or endangering or damaging communication networks.

The Sublette County HMPC noted that Pinedale gas experienced damage caused by lightning and power surges, which have previously caused damage to the SCADA system and other parts of the electrical equipment monitoring water and wastewater treatment in the town. Lightning has also taken out two communications towers during a thunder-snow event in January 2017. Additionally, The Fremont County HMPC noted that lightning events can be major issues for the power system with many surge arrestors on power lines. A substation in Lander was hit in 2016 and resulted in power outages for a few hours. Strikes have resulted in cattle deaths, sometimes 6-10 from one single strike.

Economy

Economic impact of a severe thunderstorm is typically short term. Lightning events can cause power outages and fires. Generally, long-term economic impacts are caused by hazards that result from a severe thunderstorm, including wildfires ignited by lightning. Similarly with the previous section, lightning can cause structural damage or damage to electrical systems to private buildings as well as critical infrastructure.

Environment and Cultural Resources

There are no indications that cultural or historic resources are more vulnerable to lightning than as previously accounted for as general structures. Natural resources may be vulnerable to indirect impacts of lightning, such as wildfires caused by lightning strikes. The presence of large areas of water, or of wide, open spaces in natural habitats may increase the danger of lightning strikes to trees, people, or structures, but these vulnerabilities are not directly related to natural resources. Campgrounds are areas where lightning strikes have more dangerous impacts, so populations utilizing the campgrounds may have a higher vulnerability.

Lightning can also have many cascading impacts, including power failure and ignition of wildfires. Vaisala also reported that lightning-triggered wildfires account for 58% of total acreage burned by wildfires each year.

Development Trends

Any development built above ground will be susceptible to lightning strikes. Buildings should be built with grounding, when possible, to prevent the ignition of structure fires. New critical facilities such as communications towers should be built with lightning protection measures. Construction of lightning shelters at outdoor venues and increased public awareness campaigns may help minimize increased effects of lightning on growing numbers of visitors recreating outdoors.

Risk Summary and Overall Significance by Jurisdiction

Lightning is an annual occurrence in Region 5, although strikes with recorded impacts are much rarer. Anything that can conduct electricity and is exposed is vulnerable to lightning strikes and their effects. Future impacts from lightning are difficult to determine because of the erratic nature of storms. The hazard is rated high in significance due to the impacts to SCADA infrastructure, the potential to spark wildfires, and cause death or injury.

Table 4-61 Lightning Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Significant	Highly Likely	Limited	High
Sublette	Significant	Highly Likely	Limited	High
Wind River Reservation	Significant	Highly Likely	Limited	High

4.2.14 Mine Subsidence

Hazard/Problem Description

Underground coal mining began in Wyoming during the 1860s. Many of the early coal mines were not designed and constructed well. Many were also shallow, and often had minimal ground support in the form of mine timbers. As a result the underground pillars can fail. If enough pillars fail, the caprock in the mine will collapse. The effect of the collapse reaches the surface in some cases. If the effect of the collapse reaches the surface, a subsidence pit or trough forms. Not all subsidence from mining is due to poor design, however. Most underground mines eventually have roof failures due to lack of maintenance and continuous loading of the unsupported rock layers overhead. In some cases the pillars were pulled as mining retreated from an area. In other cases fires occurred in the mines, resulting in a loss of strength in the pillars and caprock, as well as consumption of remaining coal in seams supporting workings.

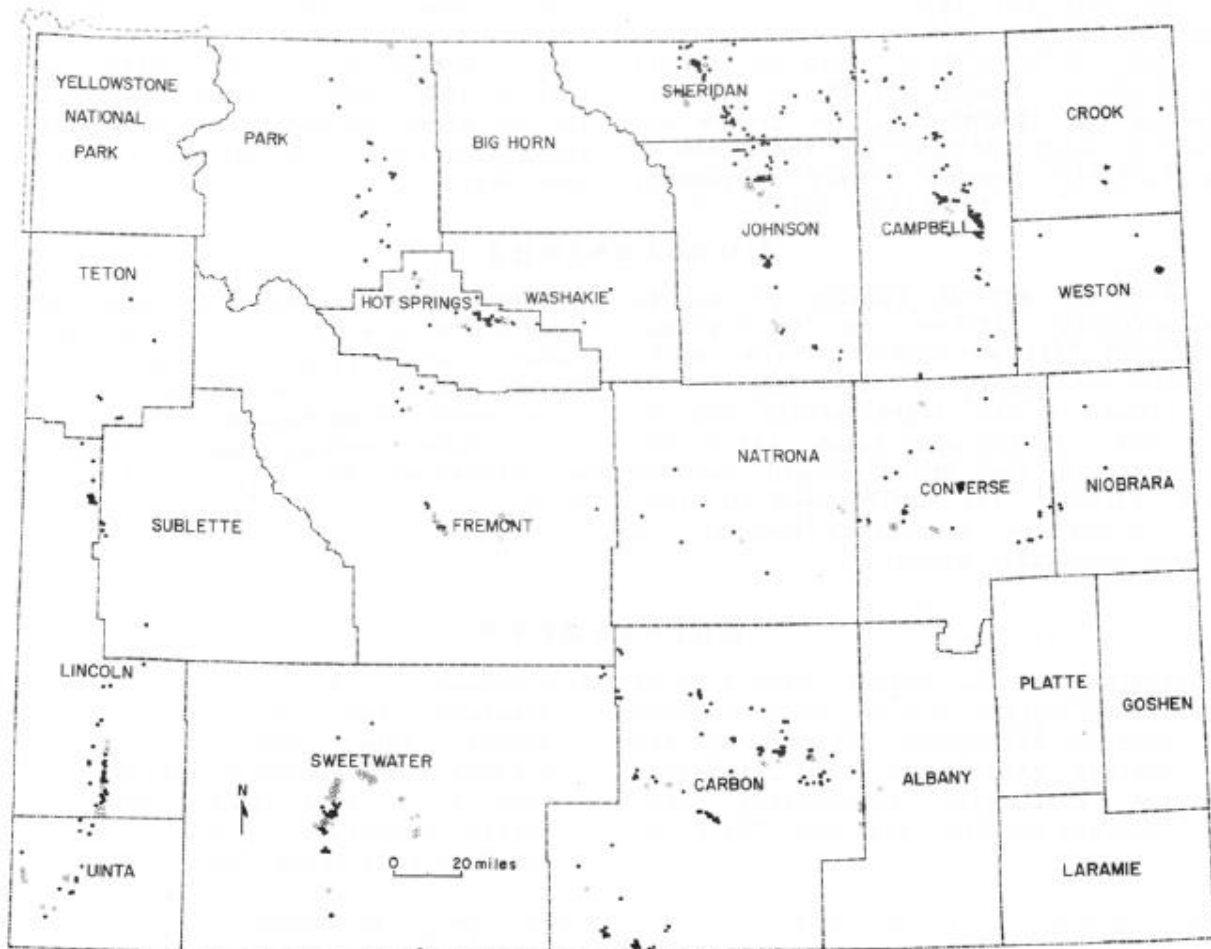
The Abandoned Mine Land Division (AML) of the Wyoming Department of Environmental Quality (DEQ) maintains an inventory of abandoned mines in the state and have recorded and actively pursued mitigation of mined out areas throughout the state. Two AML GIS inventory projects have been completed, one in 2001 and the other in 2004, where staff physically visited and geolocated mined out areas. One recent mitigation project included generating GIS layers using historic mine maps to identify mined out abandoned coal mines. The layer was then overlaid with known infrastructure such as pipelines, power lines, roads, and other utilities, as well as general developed areas to provide GIS mapping of areas with potential subsidence risks due to mined out sites. Since then, a further refinement of underground coal mine boundaries' intersection with infrastructure has occurred under AML Project 17.6B – Mine Subsidence Mitigation. Project 17.6B targets undermined infrastructure in order to be proactive in addressing mine subsidence. Many of

the projects include grouting as a stabilization technique. The Wyoming AML Program has accurately mapped approximately 3,000 of the nearly 4,000 reported abandoned mining sites. A high-level map showing numbers of abandoned coal mines in areas around the state is included below in Figure 4-44. More detailed, local information is available through the Wyoming AML Program upon request.

Geographical Area Affected

A map showing documented subsidence is shown in Figure 4-43 and Figure 4-44. Gray areas represent mined-out areas with subsidence.

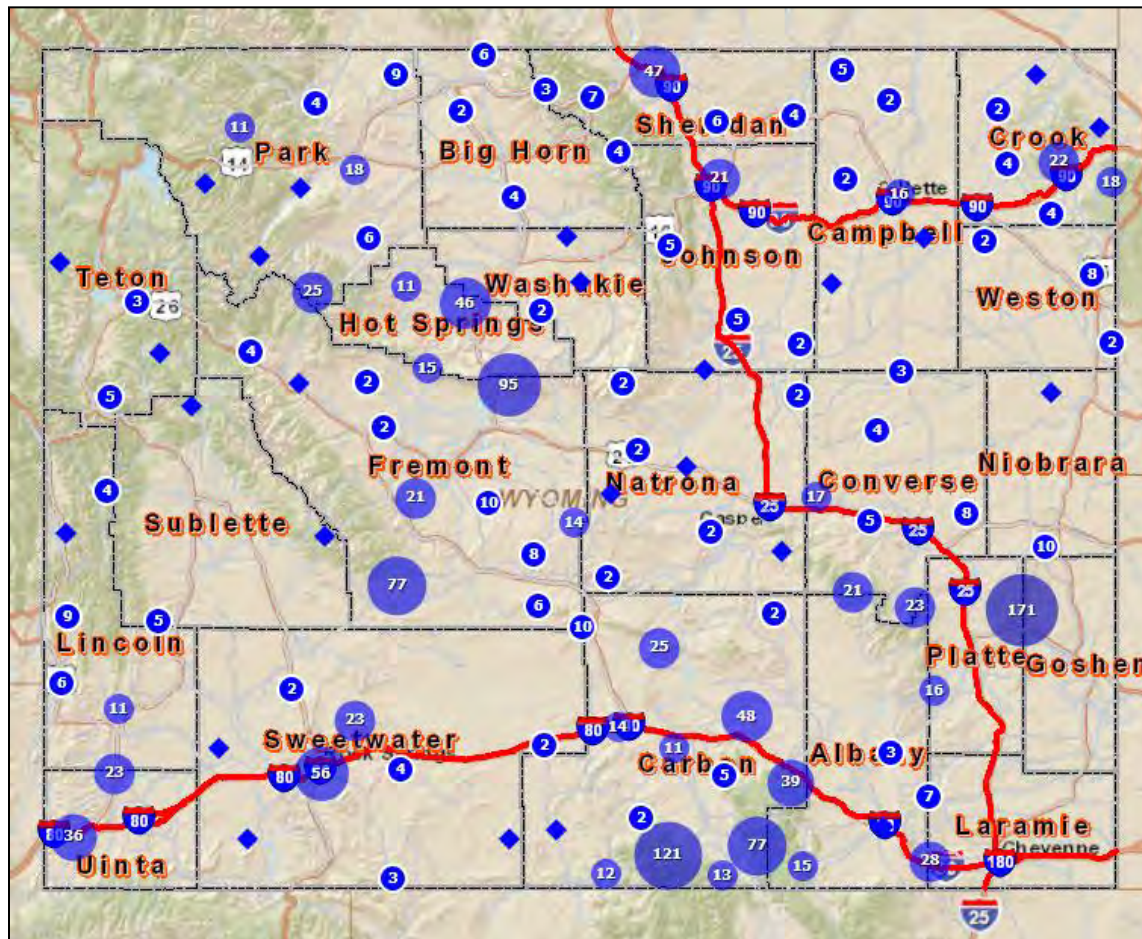
Figure 4-43 Mine Subsidence in Wyoming



Solid areas represent mined-out areas with no known subsidence.

Source: 2016 Wyoming Multi-Hazard Mitigation Plan

Figure 4-44 Abandoned Mine Sites with Subsidence-Prone Underground Workings



Source: Wyoming Department of Environmental Quality AML, 2021 Wyoming State HMP

There are numerous abandoned mine sites with subsidence-prone underground workings in Fremont County, especially in the southwestern and northeastern areas. Sublette County and the Wind River Indian Reservation both have pockets of abandoned mine sites, but not nearly as many as Fremont County.

Past Occurrences

The 2021 Wyoming Hazard Mitigation Plan addresses mine subsidence. The AML received reports of 17 new mining related subsidence issues during 2019, mostly during spring and early summer (OSMRE 2019). This is typical timing for new subsidence features appearing due to heavy precipitation events or springtime runoff from snowmelt. This is in addition to a large number of traditional mine reclamation projects on both coal and non-coal mine sites, along with smaller projects to protect individual homeowners. Recent subsidence mitigation projects have focused on protecting critical infrastructure.

Frequency/Likelihood of Future Occurrence

Although many areas of the state have already had mitigation projects designed to reduce or remove the impacts from underground mining and subsidence, subsidence may still occur in some areas. The rating for this hazard is occasional (between a 1 and 10 percent probability of occurrence in the next year or has a recurrence interval of 11 to 100 years).

Changing Future Conditions

Continued aging of long abandoned underground coal mines increases the likelihood that mine subsidence will eventually reach the ground surface. Recent studies by the Wyoming AML Program have revealed that even deep mine voids will eventually reach the surface as expressions of subsidence and may require mitigation if they threaten infrastructure and improvements or pose risks to human health and safety. Water movement and fluctuation in old mines and surface hydrology of overburden material are both factors that influence mine subsidence. Rainfall or other precipitation recharges overburden, increasing its weight per soil volume, and water percolation decreases strength of rock, aggravating the proneness of subsidence. Rainfall often triggers subsidence and a majority of subsidence events take place in spring during the rainy season (Prakash et al. 2010). Winter and spring precipitation is projected to increase for Wyoming (NOAA 2016).

Potential Magnitude (Extent)

Many mines in the Region have been identified and mitigation work has been undertaken in the past to remove the threat they pose to the surrounding area; many remaining unmitigated identified mines pose little to no threat to infrastructure in the surrounding area. Any identified or unidentified mines located under or around buildings, roads, pipelines, or other critical infrastructure can pose high risk to the surrounding area, including collapse, flooding and unsettling of the ground. These risks vary by mine.

Vulnerability Assessment

There has been property and infrastructure damage associated with mine subsidence in Wyoming communities. The dollar amounts of the damage are not readily available. Underground coal fires can also happen in abandoned mines.

The dollar impact is difficult to predict. An indirect measure of the impacts is the existing cost of mitigating the hazards. The AML Program has spent \$303.4 million through 2013 mitigating the effects of mine subsidence alone, as part of the abandoned mine reclamation program. If any of the above mines are found to be unreclaimed and appear to pose a hazard to the public, the Abandoned Mine Lands Program (AMLPL) at the Wyoming Department of Environmental Quality (DEQ) should be notified.

Specific to the Region, vulnerability to the mine subsidence hazard is generally low but should be investigated when siting future development, notably in Fremont County. In the time since 2017 an additional \$65 million has been spent on mitigation projects statewide, although none have been in Region 5.

People

According to the Wyoming DEQ, an average of 20 to 30 people die each year in abandoned mines nationwide. Information on injuries and deaths specific to subsidence incidents in Region 5 are not readily available. Hunters, hikers, cave explorers, and others recreating on public and private lands are at risk of death or serious injury. The AMLP has cataloged many abandoned mine sites in Wyoming, but many more exist in remote areas and on private land.

Property

Subsidence of abandoned mine shafts can cause damage to property located above undermined areas. The City of Rock Springs in neighboring Sweetwater County for example, has seen numerous instances of damage to residential buildings. Sagging and sinking of land resulting from mine subsidence can damage building foundations, cause sagging and cracking of roads, driveways, and sidewalks, and compromise the integrity of entire structures. The State of Wyoming has implemented a Mine Subsidence Insurance program to help protect residents from damage to structures in areas with current or past mining activity.

Critical Facilities and Lifelines

Damage to critical facilities and lifeline infrastructure is also possible from mine subsidence. Pipelines, above and below ground utility lines, roads, bridges, and communication infrastructure may all be vulnerable to the effects of mine subsidence.

Economy

Economic impacts of mine subsidence are largely the result of direct property damages and the costs of recovery and rebuilding. The Wyoming Mine Subsidence Insurance Program (WMSIP) provides coverage to eligible residential and commercial property owners throughout the state for damages resulting from mine subsidence.

Environmental and Cultural Resources

Abandoned mines and resultant subsidence can result in significant negative impacts on the environment. According to the USGS, ground subsidence can result in disturbances to the surface environment, damage to vegetation, and disruptions of the historical hydrological patterns. Additionally, fires can start by spontaneous ignition when water and air enter abandoned mine workings via subsidence cracks and pits. These fires can in turn spread to unmined coal as they create more cavities, more subsidence, and more cracks and pits through which air can circulate.

Development Trends

Locations where mine subsidence may occur are located throughout the state in both populated and unpopulated areas. Development in locations where mine subsidence occurs certainly has the potential to impact individual homes or neighborhoods. While it is believed all mined out areas in Wyoming have been mapped, it is unknown if all locations of potential subsidence have been located. The uncertainty regarding the locations of more potential subsidence areas means there is the possibility development may occur in a subsidence-prone location without the knowledge of contractors or developers prior to development. Given this fact, there is no way to determine with certainty the likelihood development will occur in a subsidence-prone location. Therefore, it is difficult to put a risk factor to this hazard as it relates to development within Wyoming's borders.

Businesses seeking to lay pipelines, electrical transmission lines, develop a well site, or build another type of business structure in an area subject to subsidence hazards are typically referred to the AML during the environmental review process. This contact helps ensure new, developing infrastructure can be routed around problem areas, or if more efficient and possible, the area can be mitigated for subsidence hazards before structures or individuals are exposed to the hazard.

Risk Summary and Overall Significance by Jurisdictions

Wyoming's long history of underground coal mining has resulted in the hazard of mine subsidence for communities across the state and in Region 5. Many of Wyoming's coal mines are along and near railroad routes through Wyoming. Mapping of Wyoming's mined areas is considered reasonably complete, though periodically a previously unmapped area is discovered and mapped. While the impacts to individual properties and structures can be significant, this hazard is generally considered to be of low significance to the communities of Region 5.

Table 4-62 Mine Subsidence Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Occasional	Limited	Negligible	Low
Sublette	Occasional	Limited	Negligible	Low

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Wind River Reservation	Occasional	Limited	Negligible	Low

4.2.15 Severe Winter Weather

Hazard/Problem Description

The National Weather Service defines a storm as “any disturbed state of the atmosphere, especially affecting the Earth’s surface, and strongly implying destructive and otherwise unpleasant weather.” Winter storms produce snow, ice, freezing rain, sleet, and/or cold temperatures. Winter storms are an annual occurrence in climates where precipitation may freeze and are not always considered a disaster or hazard. Disasters occur when the severe storms impact the operations of the affected community by damaging property, stalling the delivery of critical services, or causing injuries or deaths among the population.

Winter storm watches and warnings may be helpful for determining the difference between a seasonal winter storm and a severe winter storm. Warnings are issued if the storm is producing or suspected of producing heavy snow or significant ice accumulations. Watches are usually issued 24 to 36 hours in advance for storms capable of producing those conditions, though criteria may vary between locations. Winter Weather Advisories are issued when a low-pressure system produces a combination of winter weather that presents a hazard but does not meet warning criteria (NWS).

Heavy snow can immobilize the counties in Region 5, isolating communities, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damages are repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result with injuries and deaths.

Winter storms in the counties of the Region, including strong winds and blizzard conditions, may cause localized power and phone outages, closures of streets, highways, schools, businesses, and non-essential government operations, and increase the likelihood of winter-weather related injury or death. People may be stranded in vehicles or other locations not suited to sheltering operations or isolated from essential services. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter storms include the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can pose significant budget impacts, as can repairing the associated damages caused by downed power lines, trees, structural damages, etc. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly.

Geographical Area Affected

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the state. Generally, severe winter storm events are considered regional, which implies the storms impact multiple counties simultaneously, often for extended time periods. It is possible for the geographic extent of the hazard to vary significantly within a single county - a regional storm may directly impact only a small portion of the planning area while still extending over a large portion of the surrounding area. However, even in these instances, the impacts and effects of a regional hazard are still felt within the planning area. Therefore, while the percent of the planning area directly affected ranges from less than 10% to 100% depending on the specific circumstances, if any portion of the planning area is impacted by the storm, then the entire planning area suffers indirect impacts.

Past Occurrences

According to the Fremont County 2012 Hazard Mitigation Plan, the largest snowstorm recorded since 1891 was on April 21-24, 1999, when Lander received 52.7 inches of snow during one event.

The most significant blizzard in Wyoming's history occurred from January 2, 1949, to February 20, 1949. Snowfall in parts of eastern and southeastern Wyoming measured up to 30 inches, with drifts 20 to 30 feet high. Seventeen people perished, along with 55,000 head of cattle and over 105,000 sheep. Total economic loss was more than \$9 million dollars. In 2022 dollars, the loss would be over \$108.7 million.

The winter storm history documented by the NCEI in the Region 5 counties extends from January 1996 to December 2021. The NCEI database lists events based on the zone they occurred in, which often include portions of multiple counties. The counties in Region 5 experienced 1,014 events that NCEI records as a winter weather incident. Total damages in the Region amounted to \$805,000 in property damage; \$500,000 of this occurred in a single storm on September 26, 2013, and included tree damage, power outages and utility damage, and blocked roads. There has been no recorded history of crop damage in the NCEI database due to severe winter weather, however the USDA Risk Management Agency has recorded crop indemnity payments for various winter weather related causes. Since 2007 there have been approximately 3,926 acres lost to frost, freeze, and cold winter weather in Sublette and Fremont Counties, and a total of approximately \$750,000 in indemnity payments.

Table 4-63 NCEI Region 5 Winter Storm Events, 1996-2021

	Events	Deaths	Injuries	Total Property Damage	Total Crop Damage
Blizzards	26	0	0	0	0
Heavy Snow	189	0	2	\$15,000	0
Winter Storm	792	0	1	\$765,000	0
Winter Weather	7	0	0	\$25,000	0
Total	1,014	0	3	\$805,000	0

Source: NCEI

The Fremont County HMPC noted an upslope event in April 1999 which reached 52 inches of snow in Lander which caused some roofs to collapse.

The Sublette County HMPC reported a bus barn collapsed from a large snow load. Other impacts from winter storms included the Bondurant Arena being condemned in 2017 due to heavy snow related damage.

The Wind River Reservation HMPC noted that 2016-2017 winter saw record snow depths on the east side of the Wind River Range.

Frequency/Likelihood of Occurrence

Winter storms are an annual occurrence in Wyoming, often occurring multiple times each winter, and affecting entire regions in their size and scope. Since 1996, the Region has averaged almost 53 days with a recorded winter incident per year.

Changing Future Conditions

Climate change has the potential to exacerbate the severity and intensity of winter storms, including potential heavy amounts of snow. A warming climate may also result in warmer winters, the benefits of which may include lower winter heating demand, less cold stress on humans and animals, and a longer growing season. However, these benefits are expected to be offset by the negative consequences of warmer summer temperatures.

Potential Magnitude (Extent)

The National Weather Service (NWS) describes different types of snow events as the following:

- **Blizzard** - Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least 3 hours.
- **Blowing Snow** - Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls** - Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers** - Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Snow Flurries** - Light snow falling for short durations with little or no accumulation.

The damages caused by severe winter storms and blizzards vary and are dependent on several factors: the duration of the storm; the geographic extent; the time of year; meteorological factors such as wind, moisture content of the snow, ground and air temperatures; and the advance warning of the storm. Impacts from the storm dictate the magnitude of the event, emphasizing that the amount of snow may not always directly correlate to how bad the storm is. Damaged power lines and dangerous or impassable roadways may forestall the delivery of critical services such as medical and emergency assistance, the delivery of food supplies and medications, or even the provision of basic utilities such as heat and running water. When events happen with a long warning time, it is possible to pre-mitigate the effects of insufficient supply levels or to pre-test emergency generators, which may prevent some of the previously described impacts from occurring. Unanticipated storms increase the number of people stranded, both in cars and at public locations, which may increase the number of injuries and deaths attributed to the event (often caused by exposure) and place uneven and unanticipated strains on public sheltering capacities. The weight of the snow, driven by the water content of the fall, increases the potential for damages caused to structures and trees. Lighter snow caused by extreme cold increases the damages caused to livestock, agriculture and landscaping due to freezing conditions. Winter storms which go through periods of thaw and freeze prolong dangerous icy conditions, increasing the likelihood of frozen and damaged water pipes, impassable or dangerous roadways, damaged communication lines, or more extensive damages to infrastructure and structures caused by seeping water freezing under roofs, porches, patios, inside sidings, or causing damage to vehicles.

The HMPC emphasized the risk that winter storms bring to crops, calving and lambing, livestock operations, power impacts, traffic accidents, and flooding.

Winter storms usually cover a significant part of the State, and as such are easier to describe regionally than on a county-by-county basis.

Vulnerability Assessment

People

The threat to public safety is typically the greatest concern during severe winter storms. While virtually all aspects of the population are vulnerable to severe winter weather, there are segments of the population that are more vulnerable to the potential indirect impacts of a severe winter storm, particularly the loss of electrical power. As a group, the elderly or disabled, especially those with home health care services that rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes or other special needs housing may also be vulnerable if electrical outages are prolonged. If they do not have a back-up power source, rural residents, and agricultural operations reliant on electricity for heating and water supplies are also especially vulnerable to power outages. According to the U.S. Department of Health and Human Services, there are 955 electricity dependent Medicare beneficiaries in Fremont County and an additional 280 beneficiaries in Sublette County. These residents would be particularly vulnerable in a power outage.

Severe winter weather also increases the vulnerability of the commuting population. While there is no way to quantify which of these accidents occur during severe winter storms versus regular winter storms, the numbers indicate that winter driving conditions raise the vulnerability of the commuting population.

Property

Property vulnerabilities to severe weather include damage caused by high winds, ice, or snowpack and subsequently melting snow. Vehicles may be damaged by the same factors, or temporarily un-useable due to the driving conditions created by severe winter weather. Contents of homes, storage units, warehouses and storefronts may be damaged if the structures are compromised or fail due to the weather, or during potential flooding caused by melting snow. Very wet snowpacks can be very heavy, and this may create strains on structures, causing partial or entire collapses of walls, roofs, or windows. This is impacted both by architecture and construction material and should be assessed on a building-by-building basis. Specific records of the costs of these damages are often tracked via insurance or other private vendors, and therefore are not readily available. Crops, livestock, and other agricultural operations are also highly vulnerable to severe winter storms.

Critical Facilities and Lifelines

The physical structures which comprise essential infrastructure are as vulnerable as those outlined in the General Property subsection of this profile. Severe winter weather may also disrupt the availability of services from essential infrastructure, including utility delivery (gas, electric and water), telephone service, emergency response personnel capabilities, road plowing, and childcare availability. Severe winter storms may even halt the operation of an area for periods of time, making the vulnerability of the counties even higher.

As mentioned previously, ice or heavy accumulations of snow, particularly with blowing and drifting snow, can temporarily incapacitate the roadway system. These accumulations also require vast amounts of overtime for County and local highway and streets departments to remove snow and melt ice. Ice storms or high winds in winter storms can cause extensive loss of overhead utility lines due to buildup either on the lines or on adjacent trees that either collapse due to the weight or blow down onto the utility lines. Services such as telephone, electricity, and cable TV are frequently affected by winter storms. The Washakie HMPC noted power line damages with outages lasting 2-4 hours; lower income populations and homes with baseboard heaters are more vulnerable in these situations.

Economy

Closure of major transportation routes during severe winter storms could temporarily isolate communities and further isolate the more remote areas in the Region. Depending on the length of the closure it could also hinder the local economy by disrupting tourism and out of county visitors, as well as the potential impacts to shipping delays from a closure. Snow removal costs can also impact budgets significantly.

According to NCEI records, since 1996 winter storm events have caused \$805,000 in property damages. The Region is estimated to experience an average annual loss of \$32,200 due to winter storm hazards.

Environment and Cultural Resources

Natural resources may be damaged by the severe winter weather, including broken trees and death of unsheltered wildlife. Unseasonable storms may damage or kill plant and wildlife, which may impact natural food chains until the next growing season. Historical areas may be more vulnerable to severe winter storms due to construction and age of structures. Cultural resources generally experience the same vulnerabilities outlined in General Property, in addition to lost revenue impacts due to transportation impacts. The overall vulnerability of these resources is medium.

Development Trends

Where building codes are applicable, future residential or commercial buildings built to code should be able to withstand snow loads from severe winter storms. Future power outages or delays in power delivery to future developments may be mitigated by construction considerations such as buried power lines. Future development will also require future considerations for snow removal capacity including equipment, personnel, and logistical support. Adequate planning will help establish the cost-effective balance.

Public education efforts may help minimize the risks to future populations by increasing knowledge of appropriate mitigation behaviors, clothing, sheltering capacities, and decision-making regarding snow totals, icy roads, driving conditions, and outdoor activities (all of which are contributors to decreased public safety during severe winter storms). New establishments or increased populations who are particularly vulnerable to severe winter storms (such as those with health concerns or those who live in communities that may be isolated for extended periods of time due to the hazard) should be encouraged to maintain at least a 72-hour self-sufficiency as recommended by FEMA. Encouraging contingency planning for businesses may help alleviate future economic losses caused by such hazards while simultaneously limiting the population exposed to the hazards during commuting or commerce-driven activities.

Risk Summary and Overall Significance by Jurisdiction

Winter Storms are generally a high significance hazard in the Region due to the widespread nature, severity, and potential impacts to life and property.

Table 4-64 Winter Weather Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Significant	Highly Likely	Limited	High
Sublette	Significant	Highly Likely	Limited	High
Wind River Reservation	Significant	Highly Likely	Limited	High

4.2.16 Tornado

Hazard/Problem Description

A tornado is a swirling column of air extending from a thunderstorm to the ground. Maximum winds in tornadoes are often confined to extremely small areas, and vary tremendously over very short distances, even within the funnel itself. Tornadoes can have wind speeds from 40 mph to over 300 mph, the majority displaying wind speeds of 112 mph or less. Erratic and unpredictable, they can move forward at up to 70 miles per hour, pause, slow down and change directions. Most have a narrow path, less than 100 yards wide and a couple of miles long. However, damage paths from major tornadoes can be more than a mile wide and 50 miles long.

In 2007, the NWS began rating tornadoes using the Enhanced Fujita Scale (EF-scale). The EF-scale is a set of wind estimates (not measurements). The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it considers the materials affected and the construction of structures damaged by a tornado. Table 4-65 describes the EF-scale ratings versus the previous Fujita Scale used prior to 2007 (NOAA 2007).

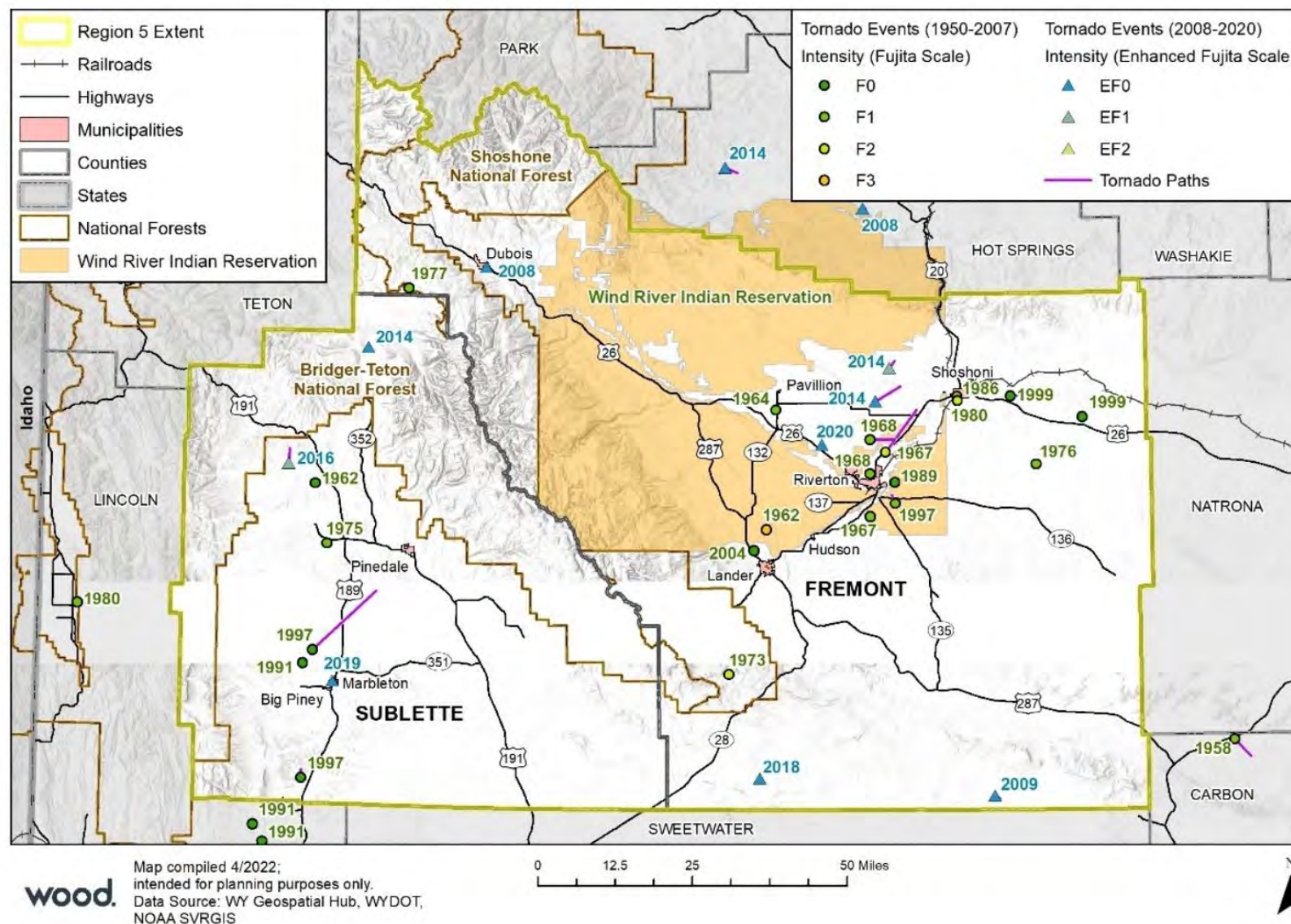
Table 4-65 The Fujita Scale and Enhanced Fujita Scale

Fujita Scale			Operational EF Scale			
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200
Notes: EF Enhanced Fujita F Fujita mph Miles per Hour						

Geographical Areas Affected

The U.S. experiences more tornadoes than any other country and the entire area of the Region is susceptible to tornadoes; therefore, the geographic areas of tornadoes are ranked as **extensive**. While some areas may see more tornadoes than others, this is more of a statistical anomaly than a causal result. Like other hazard events, greatest losses are likely to be in cities, where there is a greater concentration of infrastructure. Figure 4-45 displays the location of historic tornado events in Region 5.

Figure 4-45 Historic Tornado Events in Region 5 from 1950-2020



Past Occurrences

Tornado statistics, especially prior to the 1970s, must be viewed as incomplete since many twisters have occurred without being witnessed. Wyoming's open rangelands experience little, if any, damage from these storms, so many go unreported. Many documented tornadoes occurring in Region 5 are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage.

Since 1950, there have been 26 tornadoes between the two counties in Region 5, as documented by the NCEI Storm Event Database. From 1950-2021, there were four injuries, no fatalities, and \$648,530 in total recorded property damage in Region 5. Table 4-66 displays a summary of tornado events in Region 5 from 1950-2021, and Table 4-67 recounts the details of all recorded tornado events in the region.

Table 4-66 Summary of Tornado Events by County, Region 5

County	Incidences
Fremont	20
Sublette	6
Total	26

Source: NCEI

Table 4-67 Tornado History, Region 5

County	Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
FREMONT		6/16/1962	F3	0	0	\$2,500.00	\$0.00
FREMONT		4/23/1964	F1	0	0	\$25,000.00	\$0.00
FREMONT		6/6/1967	F2	0	2	\$250.00	\$0.00
FREMONT		6/14/1967	F1	0	1	\$25,000.00	\$0.00
FREMONT		6/5/1968	F1	0	0	\$2,500.00	\$0.00
FREMONT		6/6/1968	F1	0	0	\$25,000.00	\$0.00
FREMONT		8/27/1973	F2	0	0	\$25,000.00	\$0.00
SUBLETTE		7/30/1975	F1	0	0	\$30.00	\$0.00
FREMONT		8/3/1976	F1	0	0	\$0.00	\$0.00
FREMONT		6/20/1977	F1	0	0	\$250.00	\$0.00
FREMONT		8/3/1980	F1	0	0	\$250,000.00	\$0.00
FREMONT		6/7/1986	F2	0	0	\$250,000.00	\$0.00
FREMONT		7/9/1989	F0	0	0	\$0.00	\$0.00
SUBLETTE		5/2/1991	F0	0	0	\$0.00	\$0.00
FREMONT	RIVERTON	6/6/1997	F1	0	0	\$0.00	\$0.00
SUBLETTE	BIG PINEY	7/19/1997	F0	0	0	\$0.00	\$0.00
FREMONT	SHOSHONI	4/28/1999	F0	0	0	\$0.00	\$0.00
FREMONT	MILFORD	9/30/2004	F0	0	0	\$0.00	\$0.00
FREMONT	DUBOIS	5/28/2008	EF0	0	1	\$10,000.00	\$0.00
FREMONT	JEFFREY CITY	6/3/2009	EF0	0	0	\$0.00	\$0.00
FREMONT	MIDVALE	5/6/2014	EF1	0	0	\$12,000.00	\$0.00
SUBLETTE	GREEN RIVER LAKES	5/31/2014	EF0	0	0	\$0.00	\$0.00
SUBLETTE	WARREN BRIDGE	9/4/2016	EF1	0	0	\$1,000.00	\$0.00
FREMONT	SOUTH PASS	5/28/2018	EF0	0	0	\$0.00	\$0.00
SUBLETTE	MARBLETON	4/26/2019	EF0	0	0	\$20,000.00	\$0.00
FREMONT	(RIW)	8/11/2020	EF0	0	0	\$0.00	\$0.00

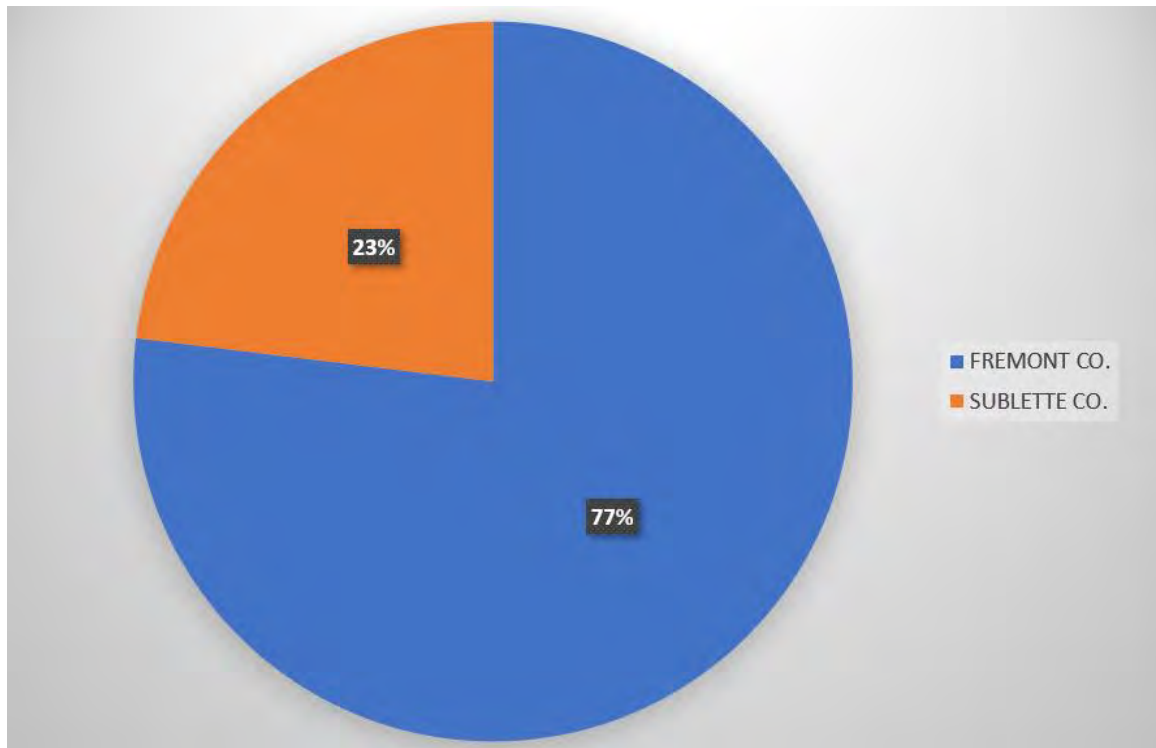
County	Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Totals				0	4	\$648,530.00	\$0.00

Source: NCEI, 29150-2021

Frequency/Likelihood of Occurrence

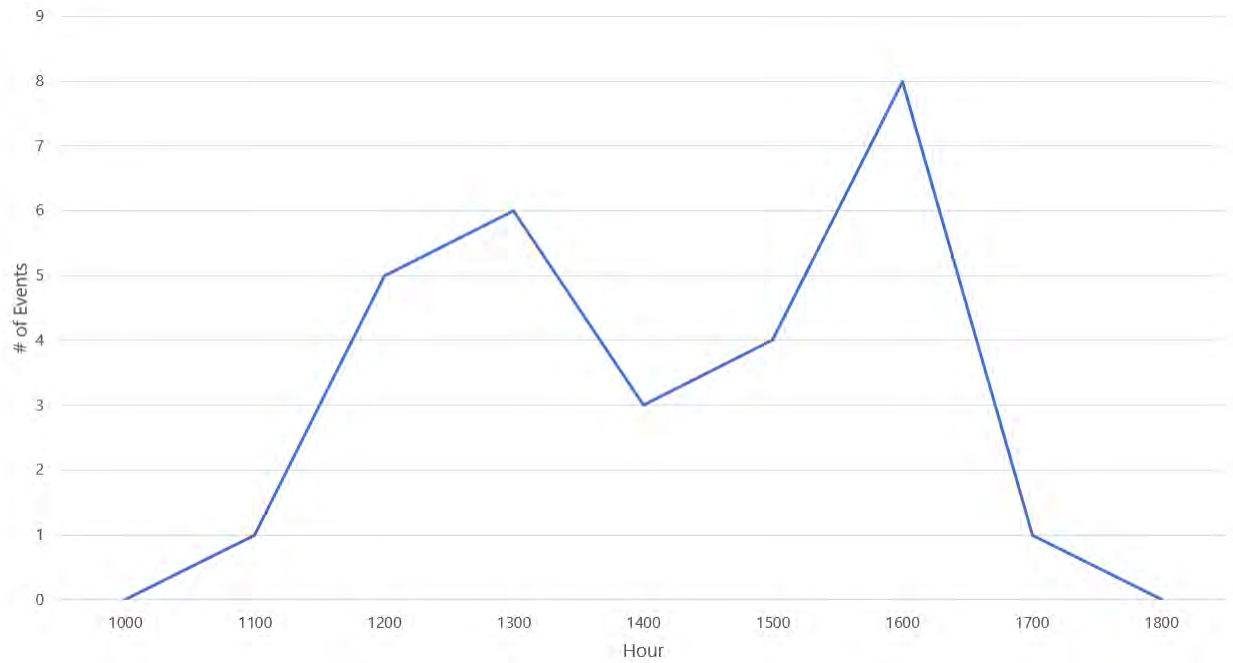
According to the NCEI Storm Events Database, a tornado occurs somewhere in the Region almost annually, therefore; frequency of tornadoes is ranked as **likely**. The peak of the tornado season is April through June, with the highest concentration of tornadoes in the central U.S. In a typical year, the U.S. averages over 1,200 tornadoes annually. In Region 5, F1 rated tornadoes were the most frequently recorded event and more than half of the recorded events resulted in significant property damage. Figure 4-46 displays tornado events by county, where it is evident that Fremont County experienced significantly more reported tornado events than Sublette County, with 20 of the 26 events happening in Fremont. Figure 4-47 and Figure 4-48 give historical perspective on the time of year and time of day that tornadoes in the region have occurred. In Region 5, tornadoes most frequently occur in the month of June in the afternoon, around 4 p.m.

Figure 4-46 Rated Tornadoes by County, Region 5



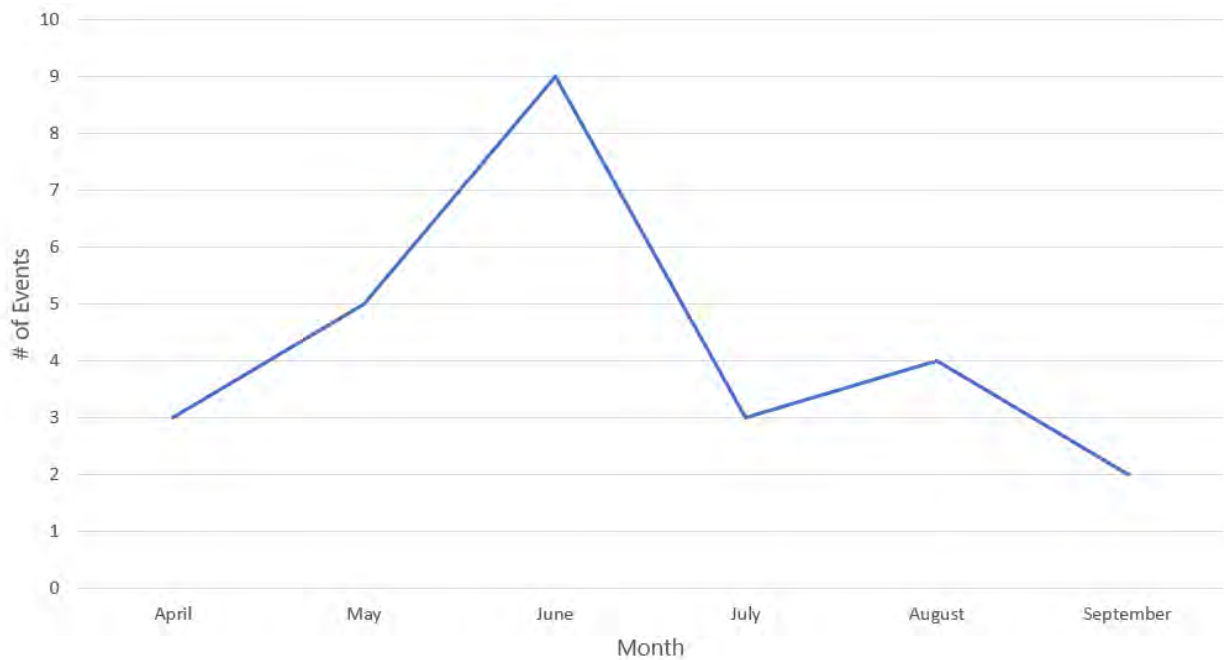
Source: data provided by NCEI; illustration created by Wood

Figure 4-47 Historical Tornadoes by Time of Day: 1958-2020, Region 5



Source: data provided by NCEI; illustration created by Wood

Figure 4-48 Historical Tornadoes by Month: 1958-2020, Region 5



Source: data provided by NCEI; illustration created by Wood

Changing Future Conditions

Climate change impacts on the frequency and severity of tornadoes are unclear. NASA's Earth Observatory has conducted studies which aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others don't, beyond knowing that they require a certain type of wind shear. Tornadoes spawn from approximately one percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. Some studies show a potential for a decrease in wind shear in mid-latitude areas. The level of significance of this hazard should be revisited over time.

Potential Magnitude

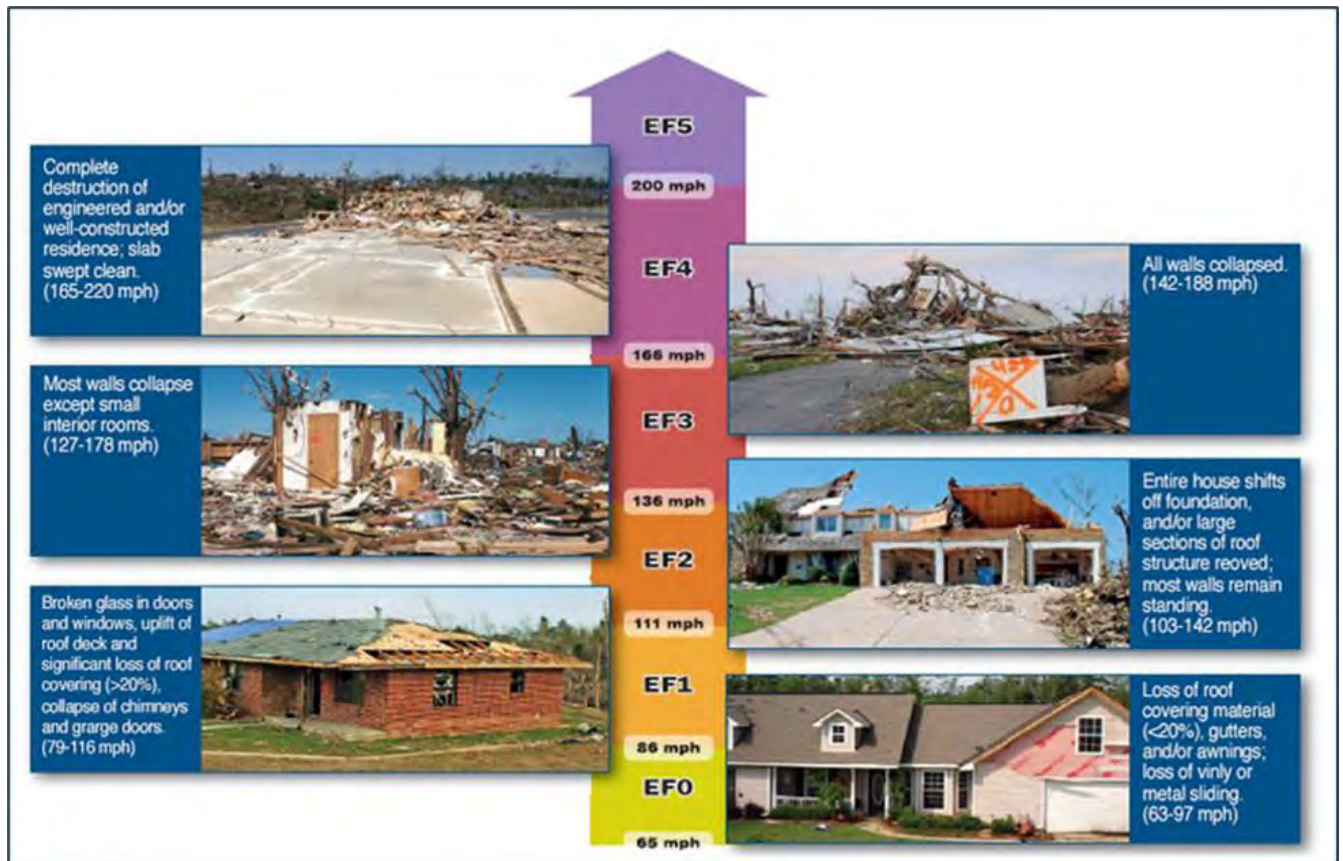
Tornadoes are potentially the most dangerous of local storms. If a major tornado were to strike within the populated areas of the Region, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. Buildings may be damaged or destroyed. However, due to the rural landscape of Region 5, tornadoes in this area don't typically cause extensive damage, therefore, magnitude of tornadoes is ranked as **limited**.

Table 4-68 shows the wind speeds associated with the Enhanced Fujita Scale ratings and the associated damage indicators associated with each rating. Visual examples of the degree of damage which could be expected with each EF rating are shown in Figure 4-49 below.

Table 4-68 Enhanced Fujita Scale with Damage Descriptions

Enhanced Fujita Scale			
Scale	Wind Speed (mph)	Relative Frequency	Potential Damage
EF0	65-85	53.5%	Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0).
EF1	86-110	31.6%	Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	10.7%	Considerable. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
EF3	136-165	3.4%	Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	0.7%	Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown and small missiles generated.
EF5	>200	<0.1%	Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur.

Figure 4-49 Potential Damage Impacts from a Tornado

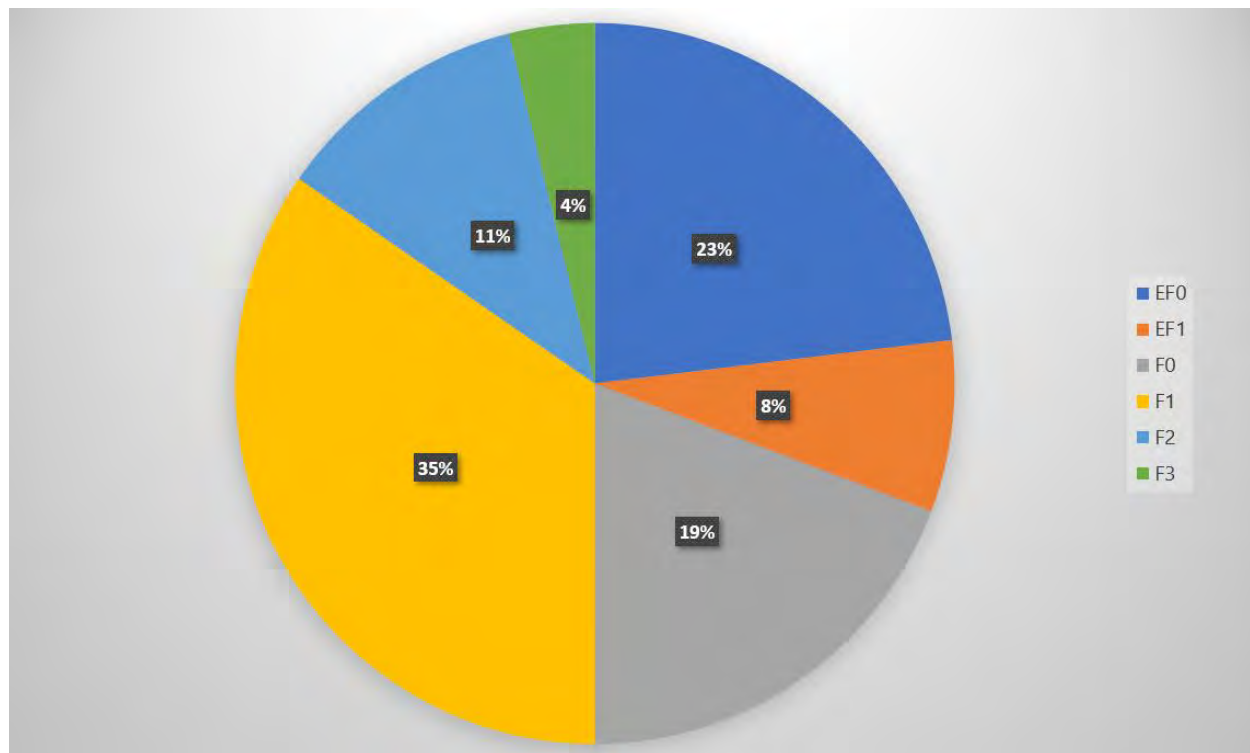


Source: National Oceanic and Atmospheric Administration

Though the strength of the tornado often dictates the impacts, it is important to remember that the location (rural or urban) of the tornado is just as important when assessing these risks. Impacts can vary depending on multiple factors, including the size and strength of a tornado, and its path. The greatest magnitude tornado in the Region was an F-3 in Fremont County on June 16, 1962. Additionally, Fremont County experienced an F-1 tornado in August of 1980 and an F-2 tornado in June of 1986, both of which caused a reported \$250,000 in damages, totaling \$500,000 in property damages due to these two events alone.

Cumulatively, past tornado events have caused \$648,530.00 in recorded property damage, and no recorded crop damage. The NCEI database describes the property damage as downed tree limbs and power outages, damage to homes, sheds, and outbuildings to include roofs and chimneys, and downed timber on forest lands. Figure 4-50 displays historic tornadoes in Region 5 by rating. In the Region, the most frequently documented tornado event rating is an F1.

Figure 4-50 F-Scale Tornadoes by Rating, Region 5



Source: data provided by NCEI; illustration created by Wood

Vulnerability Assessment

Because of its rural composition, people or property within the county have not had a history of being severely impacted during past tornado incidents. While the F-Scale ratings of historical tornadoes in the counties in the Region are typically rated an F1 or lower, the ratings are partially based on recorded damage. Recorded damage may have been much more substantial if these tornadic events had impacted one of the many communities in the Region, where dense infrastructure and human population increases possible losses. However, a vast majority of recorded events in the Region impacted rural areas where damage was limited to timber, outlying range, and farm acreage.

People

It can be assumed that the entire planning area is exposed to some extent to tornadoes. Certain areas are more exposed due to geographic location and local weather patterns. Likelihood of injuries and fatalities would increase if warning time was limited before the event or if residents were unable to find adequate shelter.

Vulnerable populations are the elderly, low income, or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. Isolation of these populations is a significant concern.

Individuals caught in the path of a tornado who are unable to seek appropriate shelter are especially vulnerable. This may include individuals who are out in the open, in cars, or who do not have access to basements, cellars, or safe rooms. The NCEI database reported 4 injuries caused by tornado events in the

Region. One of these injuries occurred on May 28th, 2008, to a woman who was in her home during the event and was injured by broken glass when flying debris broke a window in the home.

Property

All property is vulnerable during tornado events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Construction practices and building codes can help maximize the resistance of the structures to damage. Mobile homes are more vulnerable to the impacts of a tornado event compared to stick-built and other housing types due to methods of construction. Most of the property damage recorded in Region 5 by the NCEI was to trees, powerlines, and one incident of a roof removal to a public restroom.

Of the 26 tornadoes that have been recorded in Region 5 from 1950 to 2021, 15 have caused property damage and none have caused crop damage. Fremont County accounted for \$627,530 of the total property damages in the region (97%), while Sublette County totaled just \$21,000 in recorded property damages.

Critical Facilities and Lifelines

All critical facilities and infrastructure are likely exposed to tornadoes. The most common problems associated with this hazard are utility losses. Downed power lines can cause blackouts, leaving large areas isolated. Phone, water, and sewer systems may not function. Roads may become impassable due to downed trees or other debris.

Tornadoes can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Of particular concern are roads providing access to isolated areas and to the elderly. Any facility that is in the path of a tornado is likely to sustain damage.

The most serious damage would be seen in the direct path of the tornado, but secondary effects could impact the rest of the county through loss of government services and interruptions in the transportation network.

Economy

Tornado events are generally short-lived, but the impacts may last longer. Damages to commercial and private structures have the potential to be significant. Debris from the tornado would need to be collected and properly disposed of. Such an event would likely have substantial negative effects on the local economy. Tourism may also be interrupted after a tornado event. The economic impact recorded by the NCEI for Region 5 totalled to \$648,530.

Environment and Cultural Resources

Environmental features are exposed to tornado risk, although damages are generally localized to the path of the tornado. Trees are especially susceptible to damage during high winds. Broken tree branches and limbs have been reported to act as flying debris and cause damage to property during tornado events. On September 4th, 2016, a tornado in Sublette County caused tree damage approximately 300 yards across, but no property damage was recorded. Historic buildings built prior to modern building codes would be more prone to damage.

Development Trends

Any future development that is exposed and above ground will be vulnerable to a direct or indirect hit by a tornado. Generally, most areas in the Region lack building codes. In areas where building codes are not in place and enforced, buildings may not be built to withstand tornado-force winds.

Risk Summary and Overall Significance by Jurisdiction

Tornadoes are a credible threat and will continue to occur in the counties of Region 5. Depending on a tornado's size, ferocity, and path, it can cause devastating damage to people, property, and infrastructure, but due to the sporadic nature it is not possible to predict where or when they might affect populated areas in the Region. Overall, the hazard significance of tornadoes is ranked as medium.

Table 4-69 Tornado Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/ Severity	Overall Significance
Fremont	Extensive	Likely	Limited	Medium
Sublette	Extensive	Likely	Limited	Medium
Wind River Reservation	Extensive	Likely	Limited	Medium

4.2.17 Wildfire

Hazard/Problem Description

Wyoming's semi-arid climate and rural character make the state vulnerable to frequent and sometimes catastrophic wildland fires. As defined by the National Interagency Fire Center (NIFC), a "wildland fire" is any non-prescribed, non-structure fire that occurs in the wildland. Other key terms include:

- **Wildland-Urban Interface (WUI)** describes any area where man-made structures are constructed close to or within a boundary of natural terrain and fuel, where high potential for wildland fires exists.
- **Fuel** consists of combustible material, including vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.
- **Aspect** refers to the direction in which a slope faces.

Wildfires can occur at any time of the year, but are most likely to occur during the spring, summer, or fall. Thunderstorms that contain lightning frequently start wildfires. Wildfires are often also sparked by utilities and vehicles as well. According to the Wyoming State Forestry Division, the majority of wildfires in the state are started by humans.

It should be noted that wildfires are also an important natural component of the natural ecosystem. Wildlands need to burn periodically to naturally maintain viable environments. Fuel maintenance (controlled burns, mowing, cattle grazing, and other means) is a necessary replacement to uncontrolled wildland fires because of threats to human habitation.

Generally, there are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather.

- **Fuel**—Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also, to be considered as a fuel source are manmade structures, such as homes and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that can be modified by humans. The main fuel types in Fremont County are crops and grasses, while there are also brush and pine fuels present in some areas in the southwest of the county.
- **Topography**—An area's terrain and slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via

convection. The arrangement and types of vegetation throughout a hillside can also contribute to increased fire activity on slopes.

- **Weather**—Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will more readily ignite and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most influential weather factor of the three and its influence can increase rates of spread regardless of temperature and relative humidity.

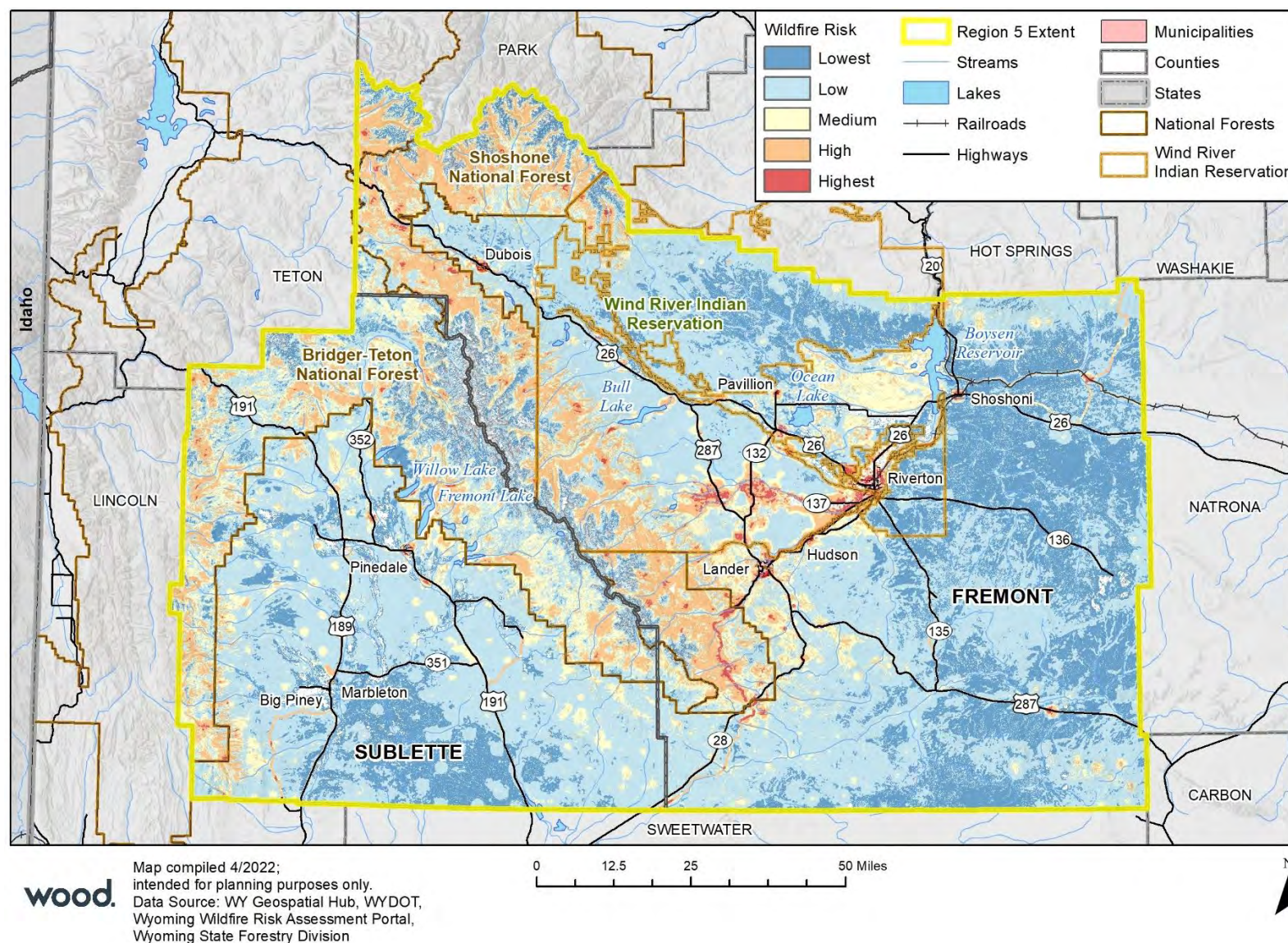
As the population and the wildland-urban interface in Wyoming increases, the risk of wildland fire becomes more significant. The past 100 years of wildland fire suppression has led to heavy vegetation growth and thus has greatly increased the potential fuel-load for a wildfire to burn. As the wildland-urban interface has grown into these densely packed forests, the potential for catastrophic wildland fires has increased as well. Fires have historically played a natural role on western landscapes. For example, some species of trees occupy sites following fire until replaced by more shade-tolerant species. In some cases, regeneration of vegetation can be enhanced by fire. Fires may have positive or negative effects, or both, depending upon the resources at risk in the fire area.

Geographical Area Affected

Certain areas of the counties in Region 5, because of their semi-arid climate and availability of fuel, are vulnerable to catastrophic wildland fires. Historically, over 50% of all wildfires in Wyoming involve wildland areas. A major portion of the Region is susceptible to wildfires, with the exception of areas above the tree line. According to the methodology for characterizing spatial extent, a significant portion of the planning area is affected by wildfires.

Figure 4-51 shows the areas at greatest risk of wildfire, based on WYWRAP data. While the threat of wildfire is statewide and regionwide, the greatest risk to people and property is concentrated near inhabited areas. The county annexes also include maps illustrating this risk of wildfire in greater detail for each of the incorporated communities in the Region.

Figure 4-51 Region 5 Wildfire Risk



The Wind River Reservation Wildland-Urban Interface Wildfire Mitigation Plan presented information on wildland fire characteristics, weather, topography, fuels, and the individual conditions, including human activity, that have led to the following assessment of vulnerability of the Reservation's most populous communities.

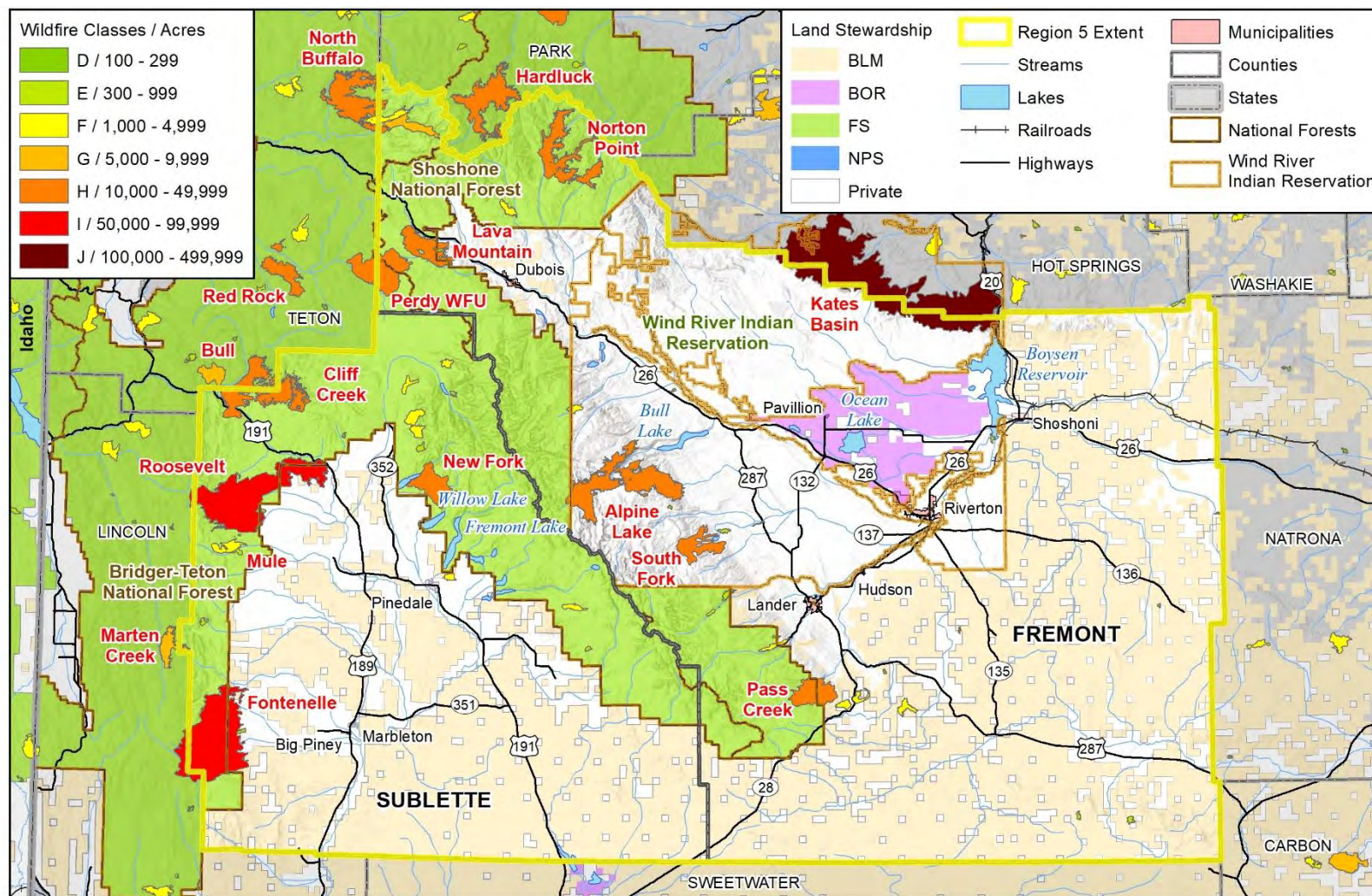
- Crowheart has characteristics that indicate that a Catastrophic Fire is possible.
- St. Stephens has characteristics that indicate that a Catastrophic Fire is possible.
- Johnstown has characteristics that indicate that a Catastrophic Fire is possible.
- Red Rocks has characteristics that indicate that a Catastrophic Fire is possible.
- Arapaho Ranch has characteristics that indicate that a Catastrophic Fire is possible.
- Ft. Washakie has characteristics that indicate that a Catastrophic Fire is likely.
- Ethete has characteristics that indicate that a Catastrophic Fire is likely.
- 17 Mile has characteristics that indicate that a Catastrophic Fire is likely.
- Arapaho has characteristics that indicate that a Catastrophic Fire is likely.
- East and West Boulder Flats has characteristics that indicate that a Catastrophic Fire is likely.

Past Occurrences

The Federal Wildland Occurrence Database, maintained by the USGS and other agencies, includes perimeter and point GIS layers for fire on public lands throughout the United States. The data includes fires dating back to 1980. The National Park Service, Bureau of Land Management, and US Forest Service reports include fires of 10 acres and greater. The database is limited to fires on federal lands. Some fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should be used cautiously for statistical or analytical purposes.

Figure 4-52 below shows a map of past wildfires that have affected Region 5 based on the Federal Wildland Occurrence Database. Some of the largest recorded fires occurred in the northwest part of the Region. One such fire was the Roosevelt Fire in 2018, one of the largest fires in Region 5. The Roosevelt Fire ultimately burned more than 61,500 acres, destroyed 55 buildings, and caused 3 non-fatal injuries, as well as resulting in a federal disaster declaration. Some of the more significant fires are detailed further in the county annexes.

Figure 4-52 Region 5 Past Wildfire Occurrences, 2000-2021



wood.

Map compiled 4/2022;
intended for planning purposes only.
Data Source: WY Geospatial Hub, WYDOT,
GeoMAC, NIFS

0 12.5 25 50 Miles



Frequency/Likelihood of Occurrence

Wildfires are highly likely to occur in the Region each year, meaning that there is nearly a 100% chance of a fire happening in any given year. It is important to note that the risk of wildfires occurring may increase during times of drought, especially prolonged droughts such as the statewide Wyoming drought that began between 1999 and 2000 and the 1988 drought in northwestern Wyoming. Table 4-70 below summarizes the average annual number of occurrences by county in Region 5, based on analysis of data from WYWRAP conducted during the 2021 Wyoming State HMP update. This information and past record of events also suggests that each county can expect at least one fire to occur annually.

Table 4-70 Region 5 Average Number of Wildfires Per Year by County, 2000-2019

Name	Annual Average
Fremont	8
Sublette	3

Source: WYWRAP, 2021 Wyoming State Hazard Mitigation Plan

Changing Future Conditions

The effects of changing future conditions have the potential to impact wildfire behavior, the frequency of ignitions, fire management, and fuel loads. Increasing temperatures may intensify wildfire threat and susceptibility to more frequent wildfires in the state. Forests are also sensitive to variable precipitation events, as drought has contributed to trees being more susceptible to pests and pathogens, in turn contributing to greater amounts of standing dead fuels. The extending of the wildfire season into winter months, coinciding with seasonal high wind patterns, can also create dangerous fire behavior.

While the recent historic trend shows a general upward trend in acreage burned per year, it is noted that not all wildfires are considered destructive given that there are positive ecological benefits from periodic fires. Suppression resources have been more focused on wildfires with life and safety threats in recent decades.

Potential Magnitude (Extent)

Most of the counties ranked the potential magnitude as limited, defined as 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days. However, wildfires can have significant economic impacts as they often coincide with the busy tourist season in the summer months. More specific consequences are discussed by county in the next section. It is important to note that the magnitude of a wildfire can be intensified by drought.

Vulnerability Assessment

People

The most exposed population are those living in the wildland-urban interface (WUI) zones, where residential properties are directly intruding into traditional wildland areas. The exposure of the population in these zones increases with the exposure of the corresponding general property, examined in the section below. Other indirect impacts from wildfires on people are related to dense smoke from fires within the region. Wildfires in the past three years have decreased the air quality throughout the entire Western United States. Dense smoke poses a risk to both people with compromised health as well as those considered healthy. A study from the University of California San Diego found that wildfire smoke is more harmful to respiratory health in humans than pollution from cars (NPR 2021). Studies have also shown an increase in ambulance calls, hospital visits, and an increase of people experiencing respiratory or cardiac emergencies (NPR 2020). A study from the U.S. EPA also linked inhalation of particle pollution with the body's reduced ability to remove inhaled foreign materials, such as viruses and bacteria, from the lungs, further compounding the

health impacts of smoke. Other particularly vulnerable groups include children, the elderly, or those with breathing conditions who may be exposed to high levels of smoke.

Population at-risk estimates were developed by multiplying the average household size from the U.S. Census for each county in the region by the number of residential structures found within the Medium, High, and Highest wildfire risk areas based on WYWRAP data. These results are shown in Table 4-71 below. It is important to note that many of these structures may include seasonal homes that could be vacant, although the likelihood of them being occupied during fire season is higher.

Table 4-71 Region 5 Population at Risk to Wildfire Hazard

	Fremont County	Sublette County
Medium Wildfire Risk	4,152	4,537
High Wildfire Risk	8,330	3,324
Highest Wildfire Risk	7,249	712
Total	19,731	8,336

Source: WYWRAP, Wood GIS Analysis

Property

The potential impacts of wildfire on property include crop loss, injury and death of livestock and pets, and damage to infrastructure, homes and other buildings located throughout the wildfire risk area, with greatest potential impact on property, buildings and infrastructure located within high and very high hazard zones including the WUI, and buildings and infrastructure located within forested lands, to include national forests and parks. Any flammable materials are vulnerable during a wildfire, including structures and personal property. The vulnerability of general property increases as the distance of the property to wildfire-prone areas decreases and is particularly high for structures located in the WUI. These structures receive an even higher level of vulnerability if the properties surrounding them are not properly mitigated for fire. Appropriate mitigation techniques include using non-flammable materials such as concrete for construction, leaving appropriate spaces between buildings and vegetation areas filled with non-flammable materials (such as decorative rock or stone), and clearing of underbrush and trees.

Another method of estimating vulnerability is to determine the value of structures that are located within wildfire risk areas. For this plan update, GIS was used to create a centroid, or point, representing the center of each parcel polygon, which was overlaid on the wildfire hazard layer. For purposes of this analysis, it was assumed that every parcel with an improved value greater than zero was developed in some way, thus only improved parcels and their values were analyzed. An analysis of the value of those parcels (the improvement value plus estimated value of building contents) quantifies the potential losses from wildfires. The results of this analysis are summarized in Table 4-72. The total values shown below include both structure value and contents and can be used as an estimate of potential losses since wildfires typically result in a total loss. An estimated \$3.2 billion in property is potentially exposed to the wildfire hazard throughout Region 5. The majority of this exposure is in Fremont County, which also includes property exposure in the Wind River Reservation. Exposure data specific to the Wind River Reservation is included in the Wind River Annex.

Table 4-72 Wildfire Hazard Exposure – General Property Summary by County

County	Jurisdiction	Parcel Count Highest	Parcel Count High	Parcel Count Medium	Total Parcel Count	Improved Value	Estimated Content Value	Total Value
Fremont County	Dubois	429	41	12	482	\$103,432,402	\$56,906,711	\$160,339,113
	Hudson	224	-	-	224	\$16,992,232	\$9,139,086	\$26,131,318

County	Jurisdiction	Parcel Count Highest	Parcel Count High	Parcel Count Medium	Total Parcel Count	Improved Value	Estimated Content Value	Total Value
	Lander	106	97	-	203	\$57,727,101	\$35,221,200	\$92,948,301
	Pavillion	69	-	-	69	\$3,431,120	\$1,853,403	\$5,284,523
	Riverton	322	228	16	566	\$156,498,950	\$95,186,775	\$251,685,725
	Shoshoni	205	19	2	226	\$26,255,838	\$14,041,442	\$40,297,280
	Unincorporated County	1,699	3,045	1,671	6,415	\$1,097,341,353	\$585,694,769	\$1,683,036,122
	Total	3,054	3,430	1,701	8,185	\$1,461,678,996	\$798,043,385	\$2,259,722,381
Sublette County	Big Piney	61	35	33	129	\$12,820,286	\$7,058,029	\$19,878,315
	Marbleton	-	120	201	321	\$44,458,249	\$25,497,029	\$69,955,278
	Pinedale	133	108	42	283	\$59,347,939	\$39,983,681	\$99,331,620
	Unincorporated County	118	1,040	1,488	2,646	\$491,046,966	\$264,492,468	\$755,539,434
	Total	312	1,303	1,764	3,379	\$607,673,440	\$337,031,207	\$944,704,647
	Grand Total	3,366	4,733	3,465	11,564	\$2,069,352,436	\$1,135,074,592	\$3,204,427,028

Source: WYWRAP, Fremont and Sublette County Assessor Data, Wood GIS Analysis

Critical Facilities and Lifelines

Wildfire impacts to critical facilities can include structural damage or destruction, risk to persons located within facilities, disruption of transportation, shipping, and evacuation operations, and interruption of facility operations and critical functions. To estimate the potential impact of wildfire on critical facilities and lifelines, a GIS overlay was performed with the wildfire hazard layers and the critical facility point data. Replacement values were not available with the data thus an estimate of potential monetary loss could not be performed. Impacts to any of these facilities could have wide ranging ramifications, in addition to property damage and other cascading impacts.

The total counts and types of critical facilities by FEMA Lifeline category are summarized below. As shown in these tables, the majority of exposed critical facilities are in Fremont County.

Table 4-73 Critical Facilities at Risk to Lowest Wildfire Risk by Jurisdiction and FEMA Lifeline

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Fremont	Unincorporated	133	8	-	1	-	-	2	144
	Total	133	8	0	1	0	0	2	144
Sublette	Unincorporated	27	2	-	-	-	-	4	33
	Total	27	2	0	0	0	0	4	33
Wind River Reservation		2	-	-	-	-	-	-	2
	Total	2	-	-	-	-	-	-	2

Source: WYWRAP, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 4-74 Critical Facilities at Risk to Low Wildfire Risk by Jurisdiction and FEMA Lifeline

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Fremont	Unincorporated	193	17	-	2	-	1	23	236
	Total	193	17	0	2	0	1	23	236
Sublette	Unincorporated	299	3	-	1	-	-	24	327
	Total	299	3	0	1	0	0	24	327
Wind River Reservation		39	-	-	-	-	-	6	45
	Total	39	0	0	0	0	0	6	45

Source: WYWRAP, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 4-75 Critical Facilities at Risk to Medium Wildfire Risk by Jurisdiction and FEMA Lifeline

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Fremont	Riverton	3	-	-	-	-	-	-	3
	Unincorporated	59	9	-	-	-	1	16	85
	Total	62	9	0	0	0	1	16	88
Sublette	Big Piney	1	-	-	-	-	-	-	1
	Marbleton	18	-	-	-	-	-	1	19
	Unincorporated	25	1	-	4	-	2	11	43
	Total	44	1	0	4	0	2	12	63
Wind River Reservation		4	5	-	-	-	-	1	10
	Total	4	5	0	0	0	0	1	10

Source: WYWRAP, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 4-76 Critical Facilities at Risk to High Wildfire Risk by Jurisdiction and FEMA Lifeline

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Fremont	Lander	2	-	-	-	-	2	-	4
	Pavillion	-	-	-	-	-	2	-	2
	Riverton	26	-	-	-	-	1	2	29
	Unincorporated	26	17	-	-	-	7	20	70
	Total	54	17	0	0	0	12	22	105
Sublette	Big Piney	-	-	1	-	-	-	-	1
	Marbleton	-	-	-	-	-	1	-	1

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
	Pinedale	6	-	-	-	-	-	1	7
	Unincorporated	26	1	-	1	-	1	20	49
	Total	32	1	1	1	0	2	21	58
Wind River Reservation		30	6	-	-	-	-	5	41
	Total	30	6	0	0	0	0	5	41

Source: WYWRAP, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 4-77 Critical Facilities at Risk to Highest Wildfire Risk by Jurisdiction and FEMA Lifeline

County	Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Fremont	Dubois	-	-	-	-	1	1	2	4
	Hudson	-	-	-	-	-	-	1	1
	Lander	5	-	-	-	-	-	1	6
	Pavillion	5	-	-	-	-	2	-	7
	Riverton	18	-	-	-	3	2	2	25
	Unincorporated	36	7	1	2	-	12	23	81
	Total	64	7	1	2	4	17	29	124
Sublette	Big Piney	2	1	-	-	-	3	-	6
	Pinedale	4	-	-	-	-	-	-	4
	Unincorporated	2	-	-	-	-	2	2	6
	Total	8	1	0	0	0	5	2	16
Wind River Reservation		14	3	-	-	-	7	7	31
	Total	14	3	0	0	0	7	7	31

Source: WYWRAP, Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Economy

The economic impacts of wildfire include loss of property, direct agricultural sector job loss, secondary economic losses to businesses in or near wildland resources like parks and national forests, and loss of public access to recreational resources. Tourism in Region 5 plays a major economic role, with the presence of many outdoor recreational opportunities both in the region and nearby. Damage to these assets or disruption of access to them can have far reaching negative impacts to the local economy. Fire suppression may also require increased cost to local and state government for water acquisition and delivery, especially during periods of drought when water resources are scarce.

Environment and Natural Resources

A large percentage of the Region includes National Forest land which contains many natural and cultural resources potentially at risk. Wildfires in the national forests may also have a regional impact on summer tourism.

While wildfire is generally beneficial to most wildlife species, negative impacts can occur where significant areas of sagebrush are burned within crucial mule deer winter range and sage-grouse breeding and winter habitats.

Other natural resources and natural areas may actually benefit from wildland fire, as at some level they must also be exposed to wildfire for a healthy ecological development of the area. Historic and cultural resources exhibit a vulnerability rating similar to those in general property, where vulnerability ratings increase the further into the WUI the property is, and the less mitigated the landscaping surrounding the property is. In addition, older buildings may be exempt from internal fire mitigation such as sprinklers and fire suppression technology, which may increase the vulnerability of the resource.

Development Trends

The wildland-urban interface (WUI) is a very popular building location, as shown by national and statewide trends. More and more homes are being built in the interface. Overall, Wyoming has less developed wildland-urban interface than most western states. Throughout Wyoming there remains potential for future home construction in undeveloped, forested private lands adjacent to fire-prone public lands. Building homes in these high-risk areas would put lives and property in the path of wildfires. Regulating growth in these areas will be a delicate balance between protecting private property rights and promoting public safety. Should the region begin to experience this type of growth, local government may wish to consider regulation of subdivision entrance/exit roads and bridges for the safety of property owners and fire personnel, building considerations pertaining to land on slopes greater than 25% (in consideration of access for fire protection of structures), and water supply requirements set forth to include ponds, access by apparatus, pumps, and backup generators. Such standards serve to protect residents and property, as well as emergency services personnel.

Risk Summary and Overall Significance by Jurisdiction

Wildfires occur within the region on an annual basis. Based on GIS analysis, the Region has over \$3.2 billion in building value potentially at risk to wildland fires. Though it is not likely that the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected. Overall, wildfire is a high significance hazard to the Region. Jurisdictional ratings are noted in the table below.

Table 4-78 Wildfire Hazard Risk Summary

County/Reservation	Geographic Extent	Probability of Future Occurrence	Potential Magnitude/Severity	Overall Significance
Fremont	Extensive	Highly Likely	Critical	High
Sublette	Significant	Highly Likely	Critical	High
Wind River Reservation	Extensive	Highly Likely	Critical	High

5 Mitigation Strategy

Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

Tribal Requirement §201.7(c)(3): A mitigation strategy that provides the Indian tribal government's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

5.1 Mitigation Strategy: Overview

This section describes the mitigation strategy process and mitigation action plan for the Region 5 Hazard Mitigation Plan. It describes how the participating jurisdictions in the Region met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of each county's HMPC led to this mitigation strategy and action plan. Section 5.2 below identifies the goals of this plan and Section 5.3 describes the mitigation action plan.

5.2 Goals and Objectives

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Tribal Requirement §201.7(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point in the planning process, each county and tribe's HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals and mitigation actions were reviewed and updated based on these tasks. During the 2022 update of this plan, each county and tribal HMPC held a series of meetings designed to achieve a collaborative mitigation strategy as described further throughout this section.

During the virtual mitigation strategy workshops held in 2022, the counties and tribes reviewed the results of the hazard identification, vulnerability assessment, capability assessment and goals from the 2017 hazard mitigation plan as well as the State of Wyoming Multi-Hazard Mitigation Plan. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the counties and tribes to update planning goals and to base the development of new or updated mitigation strategies for the counties and tribes in the Region.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and

- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable and are sometimes developed in mitigation planning as an intermediate step between goals and mitigation actions or projects.

The update/development of goals for each county and tribes in the region was initiated through a facilitated discussion at virtual planning workshops held in 2022 (Risk Assessment and Goals workshop). The HMPC members were provided a PowerPoint presentation that explained goals, objectives and actions and listed examples of each. Existing plan goals and related plan goals were noted in the PowerPoint, including the State of Wyoming Multi-Hazard Mitigation Plan (2020). This review was to ensure that the Regional plan's mitigation goals were aligned and integrated with existing plans and policies. Based on discussion at the HMPC meetings the groups decided the goals from 2017 were still valid and should be carried forward in the 2022 plan update; a minor change was made to objective 1.3 based on HMPC feedback. The Wind River Reservation decided to change their goals to align better align with goals of the counties in the Region, combining some of the goals from Fremont County with all of the goals in Sublette County.

The updated goals and objectives for each entity in the Region are noted below.

5.2.1 Fremont County Goals and Objectives

Goal 1: Protect Life and Property from Hazard Impacts

Objective 1.1: Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural and technological hazards.

Objective 1.2: Reduce losses and repetitive damages for chronic natural hazard events while promoting insurance coverage for catastrophic natural hazards.

Objective 1.3: Improve hazard assessment information to allow informed decisions on new development and encourage preventative measures for existing development in areas vulnerable to natural hazards.

Goal 2: Increase Public Awareness of Hazards

Objective 2.1: Develop and implement education and outreach programs to increase public awareness of the risks associated with natural and technological hazards.

Objective 2.2: Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.

Objective 2.3: Improve and expand hazard notification capabilities

Goal 3: Protect Natural Systems from Hazard Impacts

Objective 3.1: Balance watershed planning and natural resource management by using a "multiple use" strategy on public lands and other land use planning tactics with the outcome of natural hazard mitigation to protect life, property, and the environment.

Objective 3.2: Preserve, rehabilitate, and enhance natural systems under a multiple use strategy on public lands to serve natural hazard mitigation functions.

Goal 4: Strengthen Partnerships related to Hazard Mitigation

Objective 4.1: Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation of the mitigation plan.

Objective 4.2: Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.

Goal 5: Enhance Emergency Services and Reduce Impacts to Critical Infrastructure and Lifelines

Objective 5.1: Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.

Objective 5.2: Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.

Objective 5.3: Coordinate and integrate natural and technological hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

5.2.2 Sublette County Goals and Objectives**Goal 1: Protect life and property, implement activities that will protect lives and reduce property loss which may occur as a result of natural or man-made hazards.**

Objective 1.1: Improve emergency communications

Objective 1.2: Develop plans for dealing with health-related emergencies

Objective 1.3: Minimize flood risk by developing early warning systems

Objective 1.4: Minimize wildland fire risk by developing area evacuation plans

Objective 1.5: Provide additional sheltering facilities and supplies

Objective 1.6: Reduce economic losses including business impacts

Goal 2: Increase public awareness, provide resources for outreach and education programs to increase public awareness of risks associated with natural and man-made hazards

Objective 2.1: Improve public education and awareness programs

Objective 2.2: Implement employee emergency response training

Goal 3: Increase knowledge, gather information necessary to assess and develop plans to avoid and respond to risks and events associated with natural and man-made hazards

Objective 3.1: Educate special needs and at-risk residents about hazards and develop evacuation and emergency response plans for them

Objective 3.2: Investigate earthquake damage mitigation strategies

Objective 3.3: Improve public knowledge of county notification system

5.2.3 Wind River Reservation Goals and Objectives**Goal #1: Protect life and property, implement activities that will protect lives and reduce property loss which may occur as a result of natural or man-made hazards.**

Objective 1.2: Develop standards, codes, or zoning to minimize future disaster losses to new development

Objective 1.3: Protect existing structures from future damages

Goal #2: Increase public awareness, provide resources for outreach and education programs to increase public awareness of risks associated with natural and man-made hazards.

Objective 2.1: Promote individual and family preparedness

Objective 2.2: Improve all hazard community warning systems

Goal #3: Increase knowledge, gather information necessary to assess and develop plans to avoid and respond to risks and events associated with natural and man-made hazards.

Objective 3.1: Develop and implement Reservation training programs

Objective 3.2: Develop and implement a Hazard Education Program

Goal #4: Protect natural systems, historic and cultural resources, and the environment from the impacts of hazards.

Goal #5: Strengthen partnerships related to hazard mitigation.

Objective 5.1: Improve tribal and departments coordination

Goal #6: Enhance emergency services and reduce impacts to critical infrastructure and lifelines.

Objective 6.1: Improve urban firefighting infrastructure

Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Tribal Requirement §201.7(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

The next step in the mitigation strategy is to identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the effects of each hazard on new and existing buildings and infrastructure. During the 2022 Regional Plan update, each county and tribal HMPC analyzed viable mitigation options by hazard that supported the identified goals. The HMPCs were provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- **Plan and Regulations (Prevention):** Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural and Infrastructure Projects:** Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Public Information/Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.
- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified and profiled in Chapter 4 was evaluated. A link to reference documents titled “Mitigation Ideas” and “Mitigation Action Portfolio” developed by FEMA was made available in the meeting presentation. These documents list the common alternatives for mitigation by hazard, and best practices, respectively. The jurisdictions were asked to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options.

The mitigation strategy is based on existing local and tribal authorities, policies, programs, and resources, as well as the ability to expand on and improve these existing tools. As part of the Regional Plan development the county planning teams reviewed existing capabilities for reducing long-term vulnerability to hazards. Those capabilities are noted by jurisdiction in the county and reservation annexes and can be assessed to identify gaps to be addressed and strengths to enhance through new mitigation actions. For instance, gaps in design or enforcement of existing regulations be addressed through additional personnel or a change in procedure or policy.

Based upon the key issues identified in the risk assessment, including the capability assessment, the counties came to consensus on proposed mitigation actions for each hazard for their jurisdictions. Certain hazards’ impacts were best reduced through multi-hazard actions. A lead for each new action, where applicable, was identified to provide additional details on the project so they could be captured in the plan. Final action strategies are summarized in Section 5.3 and detailed within the respective annexes.

5.2.4 Prioritization Process

Once the mitigation actions were identified, the county and tribal planning teams were provided FEMA’s recommended prioritization criteria STAPLEE to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE is an acronym for the following:

- **Social:** Does the measure treat people fairly? (e.g., different groups, different generations)
- **Technical:** Is the action technically feasible? Does it solve the problem?
- **Administrative:** Are there adequate staffing, funding, and other capabilities to implement the project?
- **Political:** Who are the stakeholders? Will there be adequate political and public support for the project?
- **Legal:** Does the jurisdiction have the legal authority to implement the action? Is it legal?
- **Economic:** Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **Environmental:** Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

Other criteria used to assist in evaluating the priority of a mitigation action included:

- Does the action address hazards or areas with the highest risk?
- Does the action protect lives?
- Does the action protect infrastructure, community assets or critical facilities?
- Does the action meet multiple objectives (Multiple Objective Management)?

At the mitigation strategy workshops, the counties used STAPLEE to determine which of the new identified actions were most likely to be implemented and effective. Keeping the STAPLEE criteria in mind, each jurisdiction prioritized the new mitigation actions by giving an indication of relative priority, which was then translated into ‘high,’ ‘medium’ and ‘low.’ The results of the STAPLEE evaluation process produced prioritized mitigation actions for implementation within the planning area. Continued actions were also assessed to see if priority changes were needed; most of these remained the same but in some cases priorities where changed.

The process of identification and analysis of mitigation alternatives allowed the county and tribal planning teams to come to consensus and to prioritize recommended mitigation actions for their jurisdictions. During the voting process, emphasis was placed on the importance of a benefit-cost review in determining project priority as this is a requirement of the Disaster Mitigation Act regulations; however, this was a planning level analysis as opposed to a quantitative analysis. Quantitative cost-benefit analysis will be considered in additional detail when seeking FEMA mitigation grant funding for eligible projects identified in this plan.

Each mitigation action developed for this plan contains a brief description of the problem and proposed project, the entity with primary responsibility for implementation, a cost estimate, and a schedule for implementation. Development of these project details further informed the determination of a high, medium, or low priority for each. During the plan update, Sublette and Fremont Counties and the Northern Arapaho and Eastern Shoshone tribes identified some mitigation actions to be carried forward from previous regional hazard mitigation plan. Priority levels on these actions were revisited and, in some cases, modified to reflect current priorities based on the STAPLEE principles.

5.3 Mitigation Action Plan

Requirement §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Tribal Requirement §201.7(c)(3)(iii): An action plan describing how the actions identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the Indian Tribal government.

This section outlines the development of the mitigation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan's goals. Over time the implementation of these projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

5.3.1 Progress on Previous Mitigation Actions

This Regional Plan represents a plan update for both counties and the tribes. As part of the update process the HMPC reviewed the previously identified actions to assess progress on implementation. These reviews were completed using worksheets to capture information on each action including if the action was completed or deferred to the future. Actions that were not completed were discussed for continued relevance and were either continued in the Plan or in some cases recommended for deletion. The following is a summary of the number of mitigation actions in each county and for the tribes, organized by hazards, that was identified in 2017, providing the baseline for the 2022 mitigation action strategy update.

Table 5-1 2017 Mitigation Action Summary by Hazard and Jurisdiction

Hazard	Fremont	Sublette	Wind River	Total Actions
Multi-Hazard	11	8	8	27
Drought	4	1	1	6
Earthquake	2	1	4	7
Landslide	2	1	0	3
Severe Weather	3	6	0	9
Wildfire	4	3	7	14
Flood	8	5	5	18
Dam Failure	0	1	0	1
HazMat	0	2	1	3

Hazard	Fremont	Sublette	Wind River	Total Actions
Avalanche	0	1	0	1
Total	34	29	26	89

The counties and the majority of their participating jurisdictions have been working steadily towards meeting the plan's goals. While several remain to be completed, many were noted as in-progress. Progress on mitigation actions previously identified in these planning mechanisms are detailed in the mitigation action strategy in the jurisdictional annexes. These action plans were also shared amongst the regional plan participants to showcase progress and stimulate ideas amongst the respective planning committees in each county and tribe. Reasons that some actions have not been completed include low priority, lack of funding, or lack of administrative resources. See the county and tribal annexes for more details on progress on implementation.

As of December 2022, for Sublette and Fremont Counties no actions have been completed, one has been deleted, and 50 continuing in the 2022/2023 Region 5 Plan. During the 2022 process, nine new actions were developed. The table below summarizes progress implementing mitigation actions by county, inclusive of the municipalities. Mitigation actions for municipalities that did not participate in the 2022 plan update are considered "continuing" should they decided to participate in future updates. Further details on each mitigation action can be found in the jurisdictional annexes.

Table 5-2 Mitigation Action Progress Summary by County and Reservation

County/Reservation	Completed	Deleted	Continuing	New Actions in 2022	Total New/Continuing Actions
Fremont County	0	1	33	1	34
Sublette County	0	0	17	6	23
Wind River Reservation	1	1	26	2	28
Total	1	2	76	9	85

5.3.2 Continued Compliance with NFIP

Given the significance of the flood hazard in the planning area and as required by the DMA, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP). Counties and jurisdictions that participate in the NFIP will continue to make every effort to remain in good standing with the program. This includes continuing to comply with the NFIP's standards for adopting floodplain maps and maintaining and periodically updating local floodplain regulations. Actions related to continued compliance include:

- Continued designation of a local floodplain manager whose responsibilities include reviewing floodplain development permits to ensure compliance with the local floodplain management ordinances and rules;
- Suggest changes to improve enforcement of and compliance with regulations and programs;
- Participate in Flood Insurance Rate Map updates by adopting new maps or amendments to maps;
- Utilize Digital Flood Insurance Rate maps in conjunction with GIS to improve floodplain management, such as improved risk assessment and tracking of floodplain permits;
- Promote and disperse information on the benefits of flood insurance.

Also, to be considered are the flood mitigation actions contained in this Regional Plan that support the ongoing efforts by participating counties to minimize the risk and vulnerability of the community to the flood hazard, and to enhance their overall floodplain management program.

Counties and jurisdictions that participate in the NFIP, which are noted in the respective annexes Capability Assessment, will continue to make every effort to remain in good standing with the program. Both Fremont and Sublette Counties participate in the NFIP, and the municipalities of Shoshoni, Hudson, Lander, and Riverton in Fremont County and Big Piney in Sublette County do as well. This includes continuing to comply with the NFIP's standards for adopting floodplain maps and maintaining and periodically updating local floodplain regulations.

The Town of Pinedale is mapped but does not participate in the NFIP and residents can't get flood insurance as a result. According to the community the town does review development in the floodplain. As a result of this planning process the Town will continue to re-evaluate the pros and cons of participation and contact the state's NFIP coordinator at WOHS to discuss further. The Northern Arapaho and Eastern Shoshone tribes on the Wind River Reservation are not mapped and do not participate in the NFIP but are exploring participation in the future.

5.3.3 Mitigation Action Plan

The action plan presents the recommendations developed by the county and tribal planning teams, outlining how each county, the reservation, and the Region can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. The mitigation actions developed by the counties and tribes are detailed in Section 8 in each of the county annexes and reservation annex, specifically Table 8-2. These details include the action description, hazard(s) mitigated, lead and partner agencies responsible for initiating implementation, costs, and timeline. Many of the action items included in this plan are a collaborative effort among local, state, tribal and federal agencies and stakeholders in the planning area.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The counties and tribes are not obligated by this document to implement any or all of these projects. Rather, this mitigation strategy represents the desires of the community to mitigate the risks and vulnerabilities from identified hazards. The counties and tribes also realize that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, as necessary, as long as they conform to their overall goals, as listed in this plan.

Where feasible it is recommended that mitigation be integrated and implemented through existing planning mechanisms. Specific related mechanisms such as Community Wildfire Protection Plans, are noted in the county annexes. Chapter 6 also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

6 Plan Adoption, Implementation, and Maintenance

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Tribal Requirement §201.7(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan.

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, county commissioner, Tribal Council).

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the regional plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement. The system for implementation and maintenance was reviewed during the 2022 update and largely stays the same as the process detailed in the 2017 plan.

6.1 Formal Adoption

The purpose of formally adopting this plan is to secure buy-in from participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan. The governing board for each participating jurisdiction has adopted this local hazard mitigation plan by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix B, Plan Adoption. This plan will be updated and re-adopted every five years in concurrence with the required DMA local and tribal plan update requirements.

6.2 Implementation

Once adopted, the plan faces the truest test of its worth: continued implementation. While this plan contains many worthwhile actions, each county, jurisdiction, and tribe will need to decide which action(s) to undertake or continue. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the benefits to the counties, tribes, communities, and stakeholders. This effort is achieved through the routine actions of monitoring meeting agendas for hazard mitigation related initiatives, coordinating on the topic at meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This will include

creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the Region and its counties and tribes will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

6.2.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, the Region, its counties, municipalities, and the tribes will be responsible for the plan implementation and maintenance. Each county and tribe, led by their Emergency Management Coordinators, will reconvene their HMPC for plan implementation and maintenance. This HMPC will be the same committee (in form and function, if not actual individuals) that developed this HMP and will also be responsible for the next formal update to the plan in five years.

The county-level and tribal HMPCs will:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to county and municipal officials; and
- Inform and solicit input from the public.

Each HMPC will not have any powers over respective county or tribal staff; it will be purely an advisory body. The primary duty is to see the plan successfully carried out and to report to the county commissioners, municipal boards, tribal councils, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on county websites (and others as appropriate).

6.3 Plan Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized. The regulation at 44 CFR§201.6(d)(3) requires that a local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding.

Similarly, tribal governments are required by 44 CFR 201.7(d)(3) to review and revise its plan to reflect any changes in development, progress in mitigation efforts, and changes in priorities and to resubmit it for approval within 5 years in order to continue eligibility for FEMA assistance.

6.3.1 Maintenance Schedule

The Emergency Management Coordinators are responsible for initiating plan reviews and consulting with the heads of participating departments in their own counties and tribes. In order to monitor progress and update the mitigation strategies identified in the action plan, each county and tribe and their standing HMPC will conduct an annual review of this plan and/or following a hazard event. An annual mitigation action progress report will be prepared by the Emergency Management Coordinators based on the HMPC

input and kept on file to assist with for future updates. The annual review will be conducted by re-convening each HMPC in November of each year.

This plan will be updated, approved and adopted within a five-year cycle as per Requirement §201.6(c)(4)(i) (for local governments) and §201.7(d)(3) (for Tribes) of the Disaster Mitigation Act of 2000 unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. The Region and its counties and tribes will inquire with WOHS and FEMA for funds and or technical assistance to assist with the update. The next plan update should be completed and reapproved by WOHS and FEMA Region VIII within five years of the FEMA final approval date. The planning process to prepare the update should begin no later than 12 months prior to that date.

6.3.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of new or altered hazards
- Increased vulnerability as a result of new development.

Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, each county and each tribe will adhere to the following process:

- A representative from the responsible office identified in each mitigation measure will be responsible for tracking and reporting on an annual basis to the department lead on action status and provide input on whether the action, as implemented, meets the defined objectives and is likely to be successful in reducing vulnerabilities.
- If the action does not meet identified objectives, the lead will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring success of the action, and making any required modifications to the plan.

Changes will be made to the plan to accommodate for actions that were not successful or were not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as each HMPC deems appropriate and necessary, and as approved by the respective participating agencies. In keeping with the five-year update process, the HMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the governing council of each participating jurisdiction.

The Wind River Annex explains in further detail the monitoring system for tracking the initiation and status of projects as well as project closeouts, indicating who will be responsible for implementing and maintaining this system for the Northern Arapaho and Eastern Shoshone tribes.

6.3.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other county or tribal plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As described in each county and reservation annex capability assessment, the jurisdictions already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- County, tribal or community comprehensive plans
- County, tribal or community land development codes
- County, tribal or community emergency operations plans
- Threat and Hazard Identification and Risk Assessments (THIRA)
- Community Wildfire Protection Plans (CWPP)
- Transportation plans
- Capital improvement plans and budgets
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands
- Master planning efforts
- River corridor planning efforts
- Office of State Lands and Investments Drinking Water or Clean Water Intended Use Plan
- Other plans, regulations, and practices with a mitigation aspect

The county annexes note, where applicable, how the previous versions of the hazard mitigation plan have been incorporated into existing planning mechanisms in the past 5 years. Each annex and the reservation annex note specific opportunities to integrate the mitigation plan into other mechanisms in the future.

HMPC members involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As described in Section 6.2 Implementation, incorporation into existing planning mechanisms will be done through the process of:

- Monitoring other planning/program agendas;
- Attending other planning/program meetings;
- Participating in other planning processes;
- Ensuring that the related planning process cross-references the hazard mitigation plan, where appropriate, and
- Monitoring community budget meetings for other community or tribal program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

6.3.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, social media postings, press releases to local media, and through public hearings.

When each HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. Public notice will be posted, and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets, primarily newspapers. Per DMA requirements the public will be provided an opportunity to provide input during the plan update process, and before the plan is finalized. This can be accomplished through public surveys or meetings. Public comments will be solicited on the plan update draft by posting the plan online and soliciting review and comment for a minimum of two weeks.

Fremont County Annex

Wyoming Region 5
Hazard Mitigation Plan

2023-2028

1 Mitigation Planning and Fremont County Planning Team

This County Annex builds upon previous versions of the Fremont County Multi-Hazard Mitigation Plan that were incorporated into the regional hazard mitigation plan completed in 2017. The plan is the result of a collaborative effort between Fremont County Government, municipal governments, citizens, public agencies, non-profit organizations, and the private sector. Fremont County Emergency Management was responsible for updating the plan in coordination with a multi-jurisdictional County Planning Team/Hazard Mitigation Planning Committee (HMPC) during the update of the 2022 Regional Plan. The following jurisdictions were provided the opportunity to participate in the planning process:

- Town of Dubois
- Town of Hudson
- City of Lander
- Town of Pavillion
- City of Riverton
- Town of Shoshoni

The City of Riverton and towns of Pavillion and Shoshoni declined to participate as adopting jurisdictions in the 2022 regional plan update process. Details and mitigation actions related to these jurisdictions have been carried forward from the 2017 regional plan, should participation be desired in future update cycles. More details on the planning process followed and how the counties, municipalities and stakeholders participated can be referenced in Chapter 3 of the base plan, as well as how the public was involved during the 2022 update. Additional details on which local government departments invited to participate and titles of representatives are listed in Section 3.3 of the base plan.

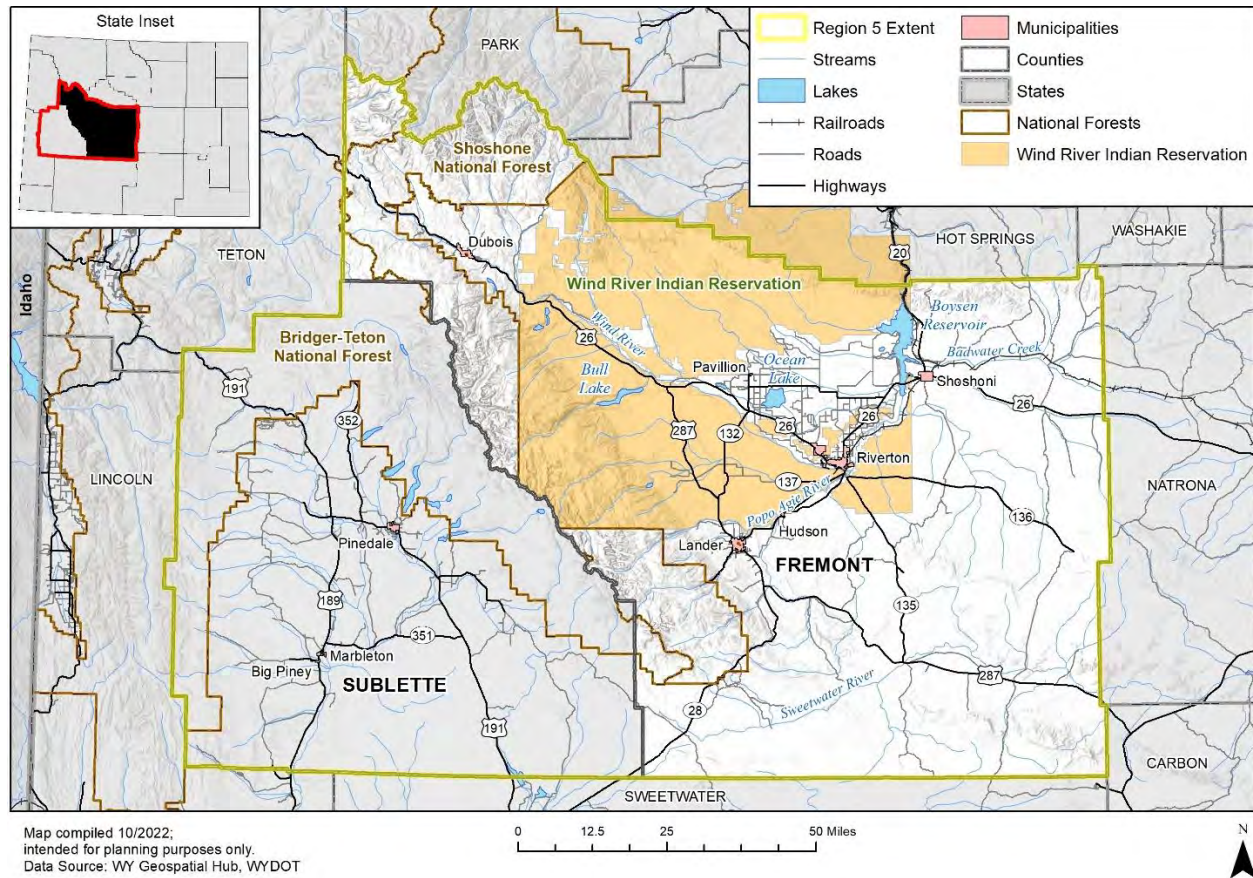
2 Geography and Climate

Much of Fremont County is made up of the 9,266 square mile Wind River Basin. This basin is typical of other large sedimentary and structural basins in the Rocky Mountain West. Broad belts of folded and faulted mountain ranges surround the basin. These ranges include the Wind River Range on the west, the Washakie Range and Owl Creeks and southern Big Horn Mountains on the north, the Casper Arch on the east, and the Granite Mountains on the south.

Fremont County is characterized by dramatic elevation changes. Surface elevations range from 13,783 feet above sea level on Gannett Peak, which is the highest point in Wyoming, to 4,800 feet on the Sand Mesa west of Boysen Reservoir. Although there is nearly 9,000 feet separation between the highest and lowest elevations in the County the average elevation is 5,500 feet.

According to the Koppen climate classification system, the city of Riverton has a cold semi-arid climate. Average temperatures at the Riverton climate station range from a summer high of 85°F to a winter low of 4.1°F. Temperature extremes range from a record high of 104°F to a record low of -46°F. Precipitation in the county varies from 60 inches per year on Gannett Peak to 8 inches per year in the central basin area of the Fremont County around Shoshoni and Riverton. Most of the inhabited area of the County receives between 8 and 14 inches of rain per year. Although not enough precipitation falls in the warmer months for adequate natural growth of crops, a tremendous amount of precipitation is accumulated in the mountains in the form of snow. Water is allocated to users on a "first in time, first in right" system.

Figure 1 Fremont County Base Map



3 Population Trends

As of the 2020 United States Census, there were a total of 39,234 people living in Fremont County. The population has remained relatively stable, with a slight decrease in population over the decade. The 2021 population was estimated to be 39,336. The County seat is the City of Lander.

Table 1 Population Estimates for Communities 2015-2020

	2010 Census	2015 Estimate	2016 Estimate	2017 Estimate	2018 Estimate	2019 Estimate	2020 Census
County Total	40,222	40,261	40,250	39,865	39,656	39,467	39,234
Town of Dubois	971	780	812	768	741	842	911
Town of Hudson	458	517	510	465	498	446	417
City of Lander	7,487	7,758	7,744	7,683	7,621	7,555	7,558
Town of Pavillion	226	244	226	220	219	194	231
City of Riverton	10,682	10,915	11,044	11,113	11,069	10,891	10,696

	2010 Census	2015 Estimate	2016 Estimate	2017 Estimate	2018 Estimate	2019 Estimate	2020 Census
Town of Shoshoni	649	530	546	508	505	515	471

Source: American Factfinder, U.S. Census www.census.gov

Select Census demographic and social characteristics for Fremont County are shown in the table below. The table indicates the proportion of the population that may have special needs, such as the elderly or children under 5 years of age.

Table 2 Fremont County Demographic Profile

Fremont County	
Population	
Population Estimates, July 1, 2021	39,336
Population, Percent Change- April 1, 2020 (estimates base) to July 1, 2021	0.3%
Population, Census, April 1, 2020	39,234
Persons Under 5 Years, Percent, 2020	6.2%
Persons Under 18 Years, Percent, 2020	25.3%
Persons 65 Years and Over, Percent, 2020	19.6%
Female Persons, Percent, 2020	49.4%
White Alone, Percent, 2020	73.5%
Black or African American Alone, Percent	0.6%
American Indian and Alaska Native Alone, Percent	22.1%
Asian Alone, Percent	0.5%
Native Hawaiian and Other Pacific Islander Alone, Percent	-
Two or More Races, Percent	3.2%
Hispanic or Latino, Percent	7.8%
White Alone, Not Hispanic or Latino, Percent	69.1%
High School Graduate or Higher, Percent of Persons Age 25 Years+	91.8%
Bachelor's Degree or Higher, Percent of Persons Age 25 Years+	24.8%

Source: U.S. Census Bureau www.census.gov

*Hispanic or Latino is considered to be an ethnicity and not a race. People who identify themselves as Hispanic or Latino can belong to one or more races. Therefore, the total percentage can be greater than 100%.

4 Development Trends

The largest incoming populations are those looking for a retirement or vacation home in the mountains where they can enjoy the outdoors. Development across the County is not uniform, and it is organized in some areas and random in others. The City of Lander, Town of Pavillion, City of Riverton, and Town of Shoshoni have seen slight population growth over the past decade, but all other jurisdictions have seen a decrease in population.

The HMPC noted that the downturn in the oil and gas industry in 2015 and ongoing has resulted in lower growth and loss of tax revenues. Limited or minimal codes do not allow control over what is developing in the County's urban and rural areas. With respect to hazards, future construction will likely increase overall exposure to earthquakes, winter storms, hail, and wind and fire in some wildland urban interface areas. New construction in Riverton and Lander could place buildings in dam failure inundation zones as well. The

HMPC also noted in 2022 that aging infrastructure in small towns with limited funding opportunities for repairs is a growing concern in the County. The HMPC also noted the unincorporated forested and riverine areas of Fremont County have become quite attractive in recent years due to proximity to outdoor activities and distance from major cities. This has created residential construction in areas that are fire and flood prone but have little or no regulation. Many of these areas are serviced by only one well maintained road which inhibits access by EMS or Fire personnel.

5 Economy

According to the U.S. Census Bureau 2020, the largest industry employer is educational services, health care, and social assistance, which employs nearly 30% of the entire workforce. The agriculture and mining industry also employs a significant portion of the population and is a major source of revenue in the County. As of the 2017 USDA Census of Agriculture, Fremont County had 1,152 farms. Fremont County has 1,165,154 acres in agriculture, which is a 32% decrease from the 2012 Census. Fremont County is ranked fourth in Wyoming in total value of crops and ninth in total livestock, poultry, and products production. Crops account for 41% of the total sales in Fremont County and livestock, poultry, and products account for 59%.

According to Mineral Answers, Fremont County is the number one producer for barrels of oil equivalent (BOE) per day as of July 2022. Additionally, Fremont County is ranked as 17 in total producers nationally. There are 2,024 total wells in the County, 880 of which are producing. In 2021, 9,038,281 BBLs of oil were produced and 456,153,677 MCFs of gas in Fremont County. The County income from the gas and oil industry was reported at \$1.27 billion.

Table 3 Fremont County Economic Profile

Characteristic	Fremont County
In Civilian Labor Force, Total, Percent of Population Age 16 Years+, 2016-2020	61.0%
In Civilian Labor Force, Female, Percent of Population Age 16 Years+, 2016-2020	56.8%
Total Accommodation and Food Services Sales, 2017 (\$1,000) (c)	127,721
Total Health Care and Social Assistance Receipts/Revenue, 2017	175,517
Total Transportation and warehousing receipts/revenue, 2017 (\$1,000) (c)	59,891
Total Retail Sales, 2017 (\$1,000) (c)	618,001
Total Retail Sales per capita, 2017 (\$1,000) (c)	\$15,502
Median Household Income (in 2020 dollars), 2016-2020	\$54,291
Per Capita Income in Past 12 Months (in 2020 Dollars), 2016-2020	\$27,475
Persons in Poverty, Percent	15.0%
Total Employer Establishments, 2020	1,243
Total Employment 2020	9,889
Total Annual Payroll, 2020	384,492
Total Employment, Percent Change 2019-2020	-0.9%
Total Non-employer Establishments, 2019	3,045

Source: U.S. Census Bureau www.census.gov/

Visitors traveling to and throughout Wyoming represent an important component of the State's, including Fremont County's, economy. Travel originating in domestic and international markets generates valuable business sales, payroll, employment, and tax receipts for the State as well as for local jurisdictions. Further, many locations within Fremont County serve as travel destinations, for both Wyoming residents and out-

of-state visitors. These areas accordingly consider travel and tourism a primary industry. The County, Lander, Dubois, and Riverton all benefit from tourism revenue.

6 Hazard Identification and Risk Assessment

6.1 Identified Hazards

The HMPC reviewed the hazards from the 2017 Fremont County Hazard Mitigation Plan for inclusion in the 2022 Regional hazard mitigation plan. The hazards list was compared with the hazards list found in the State of Wyoming's hazard mitigation plan, updated in 2020. The following table notes the summary of significance for each jurisdiction in the County based on a combination of geographic extent, likelihood and potential and magnitude/severity.

Table 4 Overall Hazard Significance* Summary Table

Hazard	County	Dubois	Hudson	Lander	Pavillion	Riverton	Shoshoni
Avalanche	Low	Low	Low	Low	Low	Low	Low
Dam Failure	Low	Low	High	High	Low	High	Low
Drought	High	High	High	High	High	High	High
Earthquake	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Expansive Soil	Low	Low	Low	Low	Low	Low	Low
Extreme Cold	Low	Low	Low	Low	Low	Low	Low
Flood	High	High	High	High	Low	High	Low
Hail	High	High	High	High	High	High	High
Hazardous Materials	Medium	Low	Medium	Medium	Low	Medium	Medium
High Winds	High	High	High	High	Medium	High	Medium
Landslide	Medium	Medium	Low	Medium	Low	Low	Low
Lightning	High	High	High	High	High	High	High
Mine Subsidence	Low	Low	Low	Low	Low	Low	Low
Severe Winter Weather	High	High	High	High	High	High	High
Tornado	Low	Low	Low	Low	Low	Low	Low
Wildfire	High	High	Medium	High	Low	High	Low

*Significance based on a combination of Geographic Extent, Potential Magnitude/Severity and Probability as defined below.

Geographic Extent

Negligible: Less than 10 percent of planning area or isolated single-point occurrences

Limited: 10 to 25 percent of the planning area or limited single-point occurrences

Significant: 25 to 75 percent of planning area or frequent single-point occurrences

Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity

Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.

Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.

Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths.

Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.

Probability of Future Occurrences

Unlikely: Less than 1 percent probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.

Occasional: Between a 1 and 10 percent probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.

Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years

Highly Likely: Between 90 and 100 percent probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance

Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.

Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.

High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

6.1.1 Hazards Considered but Not Profiled

This plan does not further evaluate the following hazards:

- Civil Disobedience
- Electrical Power Failure
- Urban Fire
- Pandemic
- Windblown Deposits
- Volcanism and Yellowstone Volcanic Explosion

It is important to be aware of the probability of these events and the associated impacts for Fremont County, however, the hazard identification described in Chapter 4 of the base plan omits these hazards due to the limited relevance in the regional context of this plan or being addressed in other planning mechanisms. Some of the above hazards are acknowledged in other hazard profiles, such as electrical power failure due to lightning, wind and winter storms. For example, power outage is not identified as an individual hazard because it is generally a consequence associated with other greater hazard events. Additionally, volcanism and a Yellowstone volcanic explosion has been excluded due to the low probability of occurrence combined with the very minimal opportunities/resources to mitigate. Windblown deposits include sands that can be mobilized by wind during extended drought, but is not considered to be a significant hazard. Pandemic was considered due to the ongoing Covid-19 Pandemic, but it was determined that the hazard is covered under existing public health plans and thus not profiled further.

6.2 Building Inventory and Assets

In addition to people, structures, critical facilities and infrastructure, and other important assets in Fremont County are potentially exposed to hazards identified in this plan. Table 5 summarizes the property inventory for the County and each participating jurisdiction, based on improvement value (i.e., structures) and includes

the building count and value grouped by parcel type and jurisdiction. This is an assessment of the overall property exposed within the County and by jurisdiction.

Assets inventoried to determine vulnerability include people, structures, critical facilities, and natural, historic, or cultural resources. For the regional planning process, locally available GIS databases were utilized. Parcel and assessor data was obtained through their respective websites which include an on-line map and data for download. This information provided the basis for building exposure and property types. The focus of the analysis was on “improved” or developed parcels. These parcels were identified based on an improvement value greater than zero. Abstract Codes were used to identify occupancy type as shown in the following table, which includes summations of total improved value for the various property types.

Table 5 Fremont County Building Inventory and Value by Jurisdiction

Jurisdiction	Improved Parcels	Improved Value	Est. Content Value	Total Exposure
Dubois	778	\$156,080,200	\$87,986,017	\$244,066,217
Hudson	324	\$25,219,726	\$13,901,215	\$39,120,941
Lander	3,066	\$607,870,710	\$374,064,970	\$981,935,680
Pavillion	116	\$5,568,780	\$2,997,570	\$8,566,350
Riverton	4,458	\$774,536,856	\$470,540,220	\$1,245,077,076
Shoshoni	473	\$45,096,261	\$25,457,355	\$70,553,616
Unincorporated	10,648	\$1,896,930,431	\$1,022,891,803	\$2,919,822,234
Total	19,863	\$3,511,302,964	\$1,997,839,149	\$5,509,142,113

Source: Wyoming CAMA 2021, Wood GIS Analysis

Total building exposure within Fremont County based on an analysis of improved parcels is more than \$5.5 billion, with over \$3.5 billion in improved value properties and close to \$2.0 billion of contents at-risk. Using GIS, parcels are assessed using tax lot data, while building counts are derived from address point locations. The unincorporated areas have the greatest total exposure with nearly \$3.0 billion, followed by Riverton with a total exposure of over \$1.2 billion.

Table 6 Fremont County Building Inventory and Value by Jurisdiction and Property Type

Jurisdiction	Property Type	Improved Parcels	Improved Value	Est. Content Value	Total Exposure
Dubois	Agricultural	3	\$7,425	\$7,425	\$14,850
	Commercial	92	\$19,884,408	\$19,884,408	\$39,768,816
	Residential	683	\$136,188,367	\$68,094,184	\$204,282,551
	Total	778	\$156,080,200	\$87,986,017	\$244,066,217
Hudson	Agricultural	1	\$1,797	\$1,797	\$3,594
	Commercial	28	\$2,580,907	\$2,580,907	\$5,161,814
	Residential	295	\$22,637,022	\$11,318,511	\$33,955,533
	Total	324	\$25,219,726	\$13,901,215	\$39,120,941
Lander	Agricultural	5	\$17,073	\$17,073	\$34,146
	Commercial	269	\$140,242,157	\$140,242,157	\$280,484,314
	Residential	2,792	\$467,611,480	\$233,805,740	\$701,417,220
	Total	3,066	\$607,870,710	\$374,064,970	\$981,935,680
Pavillion	Agricultural	1	\$5,883	\$5,883	\$11,766

Jurisdiction	Property Type	Improved Parcels	Improved Value	Est. Content Value	Total Exposure
	Commercial	6	\$420,476	\$420,476	\$840,952
	Residential	109	\$5,142,421	\$2,571,211	\$7,713,632
	Total	116	\$5,568,780	\$2,997,570	\$8,566,350
Riverton	Agricultural	5	\$113,834	\$113,834	\$227,668
	Commercial	446	\$166,429,750	\$166,429,750	\$332,859,500
	Residential	4,007	\$607,993,272	\$303,996,636	\$911,989,908
	Total	4,458	\$774,536,856	\$470,540,220	\$1,245,077,076
Shoshoni	Agricultural	2	\$7,427	\$7,427	\$14,854
	Commercial	56	\$5,811,021	\$5,811,021	\$11,622,042
	Residential	415	\$39,277,813	\$19,638,907	\$58,916,720
	Total	473	\$45,096,261	\$25,457,355	\$70,553,616
Unincorporated	Agricultural	50	\$971,238	\$971,238	\$1,942,476
	Commercial	805	\$147,881,937	\$147,881,937	\$295,763,874
	Residential	9,793	\$1,748,077,256	\$874,038,628	\$2,622,115,884
	Total	10,648	\$1,896,930,431	\$1,022,891,803	\$2,919,822,234
	Grand Total	19,863	\$3,511,302,964	\$1,997,839,149	\$5,509,142,113

Source: Wyoming CAMA 2021, Wood GIS Analysis

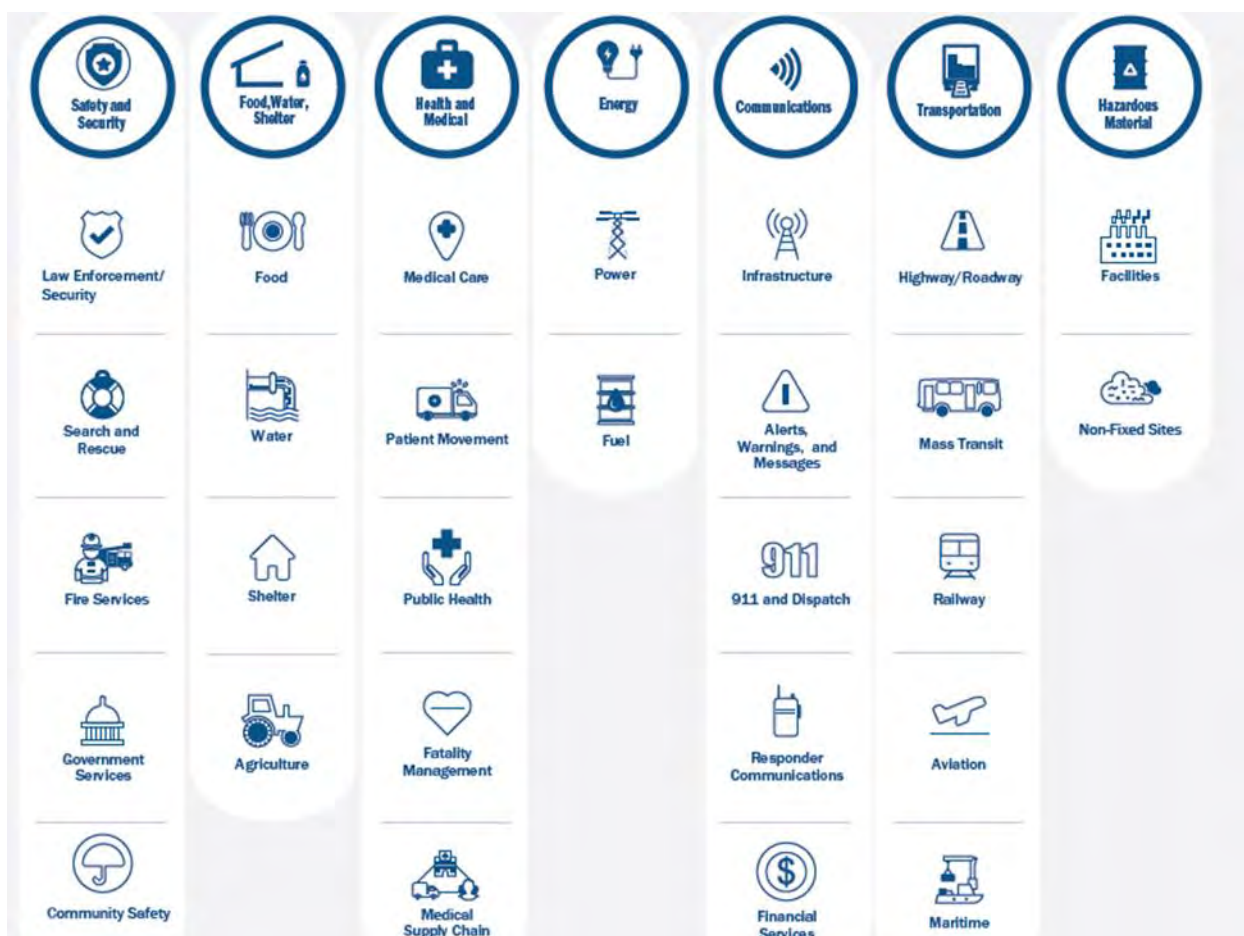
Of the \$5.5 billion of total building exposure, residential properties represent the greatest portion of structures, accounting for \$4.5 billion (82.4%), followed by \$966 million of commercial properties (17.5%), and \$2.2 million of agriculture (0.04%).

6.2.1 Critical Facilities, Infrastructure, and Other Important Community Assets

A critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. Much of this data is based on GIS databases associated with the 2022 Homeland Infrastructure Foundation-Level Data (HIFLD). Other critical facility databases were also used, such as the National Bridge Inventory (NBI) and Wyoming State Assets, with supplementation from the HMPC. Where applicable, this information was used in an overlay analysis for hazards such as flood, landslide, and wildfire.

FEMA organizes critical facilities into seven lifeline categories as shown in Figure 2.

Figure 2 FEMA Lifeline Categories



Source: FEMA

These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators).
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

Table 7 summarizes critical facility counts in Fremont County, by jurisdiction, as provided by the County, Homeland Infrastructure Foundation-Level Data (HIFLD), National Bridge Inventory (NBI), and the Wyoming State Assets.

Table 8 examines the distribution of critical facilities across each individual jurisdiction.

Table 7 Fremont County Total Facilities by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Dubois	2	1	-	-	1	7	7	18
Hudson	-	1	-	-	-	1	1	3
Lander	23	1	-	-	4	24	5	57
Pavillion	5	-	-	-	-	5	-	10
Riverton	85	3	4	-	6	29	8	135
Shoshoni	2	-	-	-	-	5	-	7
Unincorporated	476	71	1	8	1	32	159	748
Total	593	77	5	8	12	103	180	978

Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 8 Fremont County Critical Facilities by Jurisdiction

Jurisdiction	Facility Type	Facility Count
Dubois	Communications	2
Dubois	Energy	1
Dubois	Health and Medical	1
Dubois	Safety and Security	7
Dubois	Transportation	7
Hudson	Energy	1
Hudson	Safety and Security	1
Hudson	Transportation	1
Lander	Communications	23
Lander	Energy	1
Lander	Health and Medical	4
Lander	Safety and Security	24
Lander	Transportation	5
Pavillion	Communications	5
Pavillion	Safety and Security	5
Riverton	Communications	85
Riverton	Energy	3
Riverton	Food, Water, Shelter	4
Riverton	Health and Medical	6
Riverton	Safety and Security	29
Riverton	Transportation	8
Shoshoni	Communications	2

Jurisdiction	Facility Type	Facility Count
Shoshoni	Safety and Security	5
Fremont Unincorporated	Communications	476
Fremont Unincorporated	Energy	71
Fremont Unincorporated	Food, Water, Shelter	1
Fremont Unincorporated	Hazardous Material	8
Fremont Unincorporated	Health and Medical	1
Fremont Unincorporated	Safety and Security	31
Fremont Unincorporated	Transportation	159
Fremont Unincorporated	Other - Cultural Resources	1

Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 9 through Table 17 display the valuation of select critical facilities where known, sorted by jurisdiction and function. Note that critical infrastructure will continue to change as the municipalities and elected officials change. Any municipality's governing body may change their definition and considerations of what is "critical infrastructure".

Table 9 Fremont County Public Facilities

Facility	Location	Valuation
Ambulance Station	Lander – N. 1st Street	\$ 1,069,568
	Riverton – 1052 Petersdorf Drive	\$ 1,165,210
	Dubois- 706 Mechem	\$ 424,817
County Courthouse	450 N. 2nd	\$ 13,885,000
Detention Center / Dispatch Center	460 Railroad	\$ 10,212,310
Public Health Nurse	Riverton- 322 N. 8 th West	\$ 529,245
Roads Shop	Riverton – 4421 Skylane Ave	\$ 1,007,215
	Pavillion – 201 E. Dallas	\$ 576,537
	Lander – 1580 US Highway 287	\$ 1,529,340
Solid Waste Location	Sand Draw – 743 Sand Draw Road	\$ 263,175*
	Baling Station – 542 North Smith Road	\$ 339,000*
	Lander – 52 Beebe Road	\$ 893,042*

Table 10 Lander Public Facilities

Facility	Location	Valuation
City Hall	240 Lincoln	\$ 894,775
Fire Station	430 Garfield	\$ 946,554
Hospital – Lander Regional	1320 Bishop Randall Drive	\$ 14,529,623
Police Department	240 Lincoln	With City Hall
Public Works	125 Buena Vista Dr	\$ 1,802,186**
Wastewater Treatment	100 Industrial Park Road	\$ 897,750

Table 11 Riverton Public Facilities

Facility	Location	Valuation
Animal Shelter	515 S. Smith Road	No data
City Hall	816 North Federal	\$ 4,142,958
Fire Station	404 South Broadway	\$ 1,646,509
Hospital – Riverton Memorial	2100 West Sunset	\$ 7,084,232
Maintenance Shop	714 W. Monroe	\$ 434,887
Police Department	816 North Federal	With City Hall
Wastewater Treatment	2600 East Monroe	\$ 1,208,190
Water Treatment Plant	1015 N. Hill Street	\$ 863,350

Table 12 Shoshoni Public Facilities

Facility	Location	Valuation
City Hall	212 Idaho	\$ 456,005
Police Department	102 East 2 nd Street	
Public Works	S. Maple	\$ 512,292

Table 13 Hudson Public Facilities

Facility	Location	Valuation
Town Hall	333 S. Main Street	\$ 239,068
Public Works	256 S. Main Street	\$ 105,509
Water Department	6 th & Oklahoma	\$ 55,025
Water Treatment (Lagoon)	Old Hwy 789	\$ 169,130

Table 14 Dubois Public Facilities

Facility	Location	Valuation
Fire Department	107 Horse Creek Road	\$ 1,067,697
Town Hall	712 Meckem	\$ 2,140,398
Town Shop	208 D. Street	\$ 172,580

Table 15 Pavillion Public Facilities

Facility	Location	Valuation
Town Hall	203 ½ North Main	\$ 90,439
Water Storage Facilities	314 N. Pine 2 tanks located on North Pavillion Road near S & S Wood Products	\$ 28,498

Table 16 Fremont Fire Districts

Facility	Location	Valuation
Fremont County Fire Protection District	305 South Smith Road, Riverton	\$ 841,456

Facility	Location	Valuation
FCFPD Shop	E. Monroe	\$ 299,557
Lysite	30 Wyoming Street, Lysite	\$ 351,242
Lander Rural – Station #1	280 Tulip Street, Lander	\$ 233,664
Lander Rural – Station #2	14 Lower North Fork Road, Lander	\$ 172,926
Missouri Valley	330 Missouri Valley Road	\$ 1,544,400
Morton/Kinnear	11521 Hwy 26, Kinnear	\$ 1,196,000
Crowheart	8531 Hwy 26, Crowheart	\$ 255,076
Pavillion	390 West Center Ave, Pavillion	\$ 368,580
Midvale- Station #1	1554 Missouri Valley Road	\$ 211,064
Midvale – Station #2	10 Lost Wells Circle	\$ 58,493
Atlantic City	46 Dexter Ave, Atlantic City	\$ 290,367
North Portal Cottonwood	653 North Portal Road	\$ 121,903
Ft. Washakie	385 Old Wind River Hwy	Unknown
Hudson	33 South Main, Hudson	\$ 239,068***
Shoshoni	104 E. 2nd Street Shoshoni	\$ 480,000

Table 17 Fremont Education Centers

Facility	Location	Valuation
Arapaho School District #38	445 Little Wind River Bottom Road, Arapaho	
Ashgrove Elementary	510 N. 1 st Street, Riverton	\$ 7,146,892
Aspen Park Elementary	1620 E. Sunset Drive, Riverton	\$ 12,008,968
Baldwin Creek Elementary	350 Smith Street, Lander	
Crowheart School	8434 Hwy 26, Crowheart	\$ 310,495
Dubois K-12 School	700 N 1 st , Dubois	\$ 69,752,288
Dubois High School	314 Helmer Street, Dubois	
Frontier Academy	2002 W. Sunset, Riverton	\$ 1,998,911
Jackson Elementary	720 W. Jackson, Riverton	\$ 6,426,997
Jeffrey City Elementary	375 Bob Adams Ave, Lander	
Lander Valley High School	350 Baldwin Creek Road, Lander	\$ 22,827,369
Gannett Peak Elementary	615 Popo Agie, Lander	
Ft. Washakie Elementary	90 Ethete Road, Ft. Washakie	
Ft. Washakie High School	90 Ethete Road, Ft. Washakie	
Lander Middle School	755 Jefferson, Lander	
Pathfinder High School	8204 Hwy 789, Lander	Included in Training School
Rendezvous Elementary	413 N. 4 th Street West, Riverton	\$ 14,528,119
Riverton High School	2001 W. Sunset Drive, Riverton	\$ 46,884,642
Riverton Middle School	840 Major Ave, Riverton	\$ 22,901,499
Shoshoni Elementary & High School	404 Wrangler Way, Shoshoni	\$ 3,357,486
Gannett Same as Above	615 Popo Agie Street, Lander	\$ 2,552,115
St. Margaret's School	220 N 7th Street East, Riverton	

Facility	Location	Valuation
St. Stephens Indian School	134 Mission Road, Wind River Indian Reservation	
Starrett Junior High School	863 Sweetwater, Lander	\$ 7,131,636
Trinity Lutheran School	419 E. Park, Riverton	
Willow Creek Elementary	2002 W. Sunset, Riverton	\$ 12,116,893
Wind River Middle – High School & Elementary	1994 Cougar Drive, Pavillion	\$ 12,842,767
Wyoming Indian Elementary	23 Coolidge Street, Wind River Indian Reservation	
Wyoming Indian High School	636 Hwy 132, Wind River Indian Reservation	
Wyoming Indian Middle School	531 Ethete Road, Wind River Indian Reservation	
	Higher Education	
Central Wyoming College	1660 Peck Ave, Riverton	
Wyoming Catholic College	306 Main Street, Lander	
Wind River Job Corps	4200 Airport Road, Riverton	
Wind River Tribal Community College	533 Ethete Road, Ethete	

* Land value only

** Combined value of water treatment and public works shop

*** Includes City Hall value

+ Value listed on insurance purchased by municipalities

Note: All values are for structural replacement costs, at fair market values, provided by the Fremont County Assessor's Office and Insurance values and does not reflect content and equipment replacement costs.

6.2.2 Natural, Historic, and Cultural Assets

Assessing the vulnerability of Fremont County to disasters also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant more protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Historic and Cultural Resources

By definition, a historic property not only includes buildings of other types of structures, such as bridges and dams, but also includes Native American sites, roads, byways, historic landscapes, and many other features. Given the history of the County, these types of historic properties exist in the planning area.

Information about historic assets in Fremont County came from the following sources:

- The **National Register of Historic Places** is the Nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed

include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

Table 18 lists the properties and districts in Fremont County that are on the National Register of Historic Places.

Table 18 Fremont County Historic Properties

Site	Jurisdiction
Atlantic City Mercantile	Atlantic City
Hamilton City	Atlantic City
Carpenter Hotel Historic District	Atlantic City
ELS Bridge over Big Wind River	Dubois
Brooks Lake Lodge	Dubois
Welty's General Store	Dubois
Torrey Lake Club/Ranch Historic District	Dubois
Diamond A Ranch	Dubois
CM Ranch and Simpson Lake Cabins	Dubois
Torrey Lake Petroglyph District	Dubois
Twin Pines Lodge and Cabin Camp	Dubois
T Cross Ranch Rural Historic District	Dubois
Helen Lookingbill Site	Dubois
High Rise Village	Dubois
BMU Bridge over Wind River	Ethete
St. Michael's Mission	Ethete
Shoshone-Episcopal Mission	Fort Washakie
Fort Washakie Historic District	Fort Washakie
Wind River Agency Blockhouse	Ft. Washakie
Dean Decker Site	Honeycomb Buttes
Lander Downtown Historic District	Lander
US Post Office and Courthouse--Lander Main	Lander
Jackson Park Town Site Addition Brick Row	Lander
Castle Gardens Petroglyph Site	Moneta
ELY Wind River Diversion Dam Bridge	Morton
Delfelder Schoolhouse	Riverton
Riverton Railroad Depot	Riverton
Quien Sabe Ranch	Shoshoni
King, C. H., Company, and First National Bank of Shoshoni	Shoshoni
South Pass	South Pass City
South Pass City Historic District	South Pass City
South Pass City Historic District (Boundary Increase)	South Pass City
Split Rock Prehistoric Site (48FR1484)	Split Rock Ranch
Green Mountain Arrow Site (48FR96)	Stratton Rim
Union Pass	Unknown

Natural Resources

Natural resources are important to include in benefit-cost analyses for future projects and may be used to leverage additional funding for projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands preserves sensitive habitats as well as attenuates and stores floodwaters.

Wetlands

Wetlands are a valuable natural resource for communities, due to their benefits to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water. They also provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation are vital.

Endangered Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the planning area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

There are ten federally-recognized endangered, threatened, or candidate species in Fremont County according to the U.S. Fish and Wildlife Service. These species are listed in Table 19 along with State listed species.

Table 19 Endangered and Threatened Species in Fremont County

Common Name	Scientific Name	Type of Species	Status
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Bird	Recovery
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Bird	Threatened
Whitebark Pine	<i>Pinus albicaulis</i>	Conifers and Cycad	Candidate
Fremont County Rockcress	<i>Boechera pusilla</i>	Flowering Plant	Candidate
Ute ladies'-Tresses	<i>Spiranthes diluvialis</i>	Flowering Plant	Threatened
Desert Yellowhead	<i>Yermo xanthocephalus</i>	Flowering Plant	Threatened
Grizzly Bear	<i>Ursus arctos horribilis</i>	Mammal	Threatened Under Review
Black-footed Ferret	<i>Mustela nigripes</i>	Mammal	Endangered
Gray Wolf	<i>Canis lupus</i>	Mammal	Recovery
Canada Lynx	<i>Lynx canadensis</i>	Mammal	Threatened
North American Wolverine	<i>Gulo luscus</i>	Mammal	Proposed Threatened

Source: <http://www.fws.gov/endangered/>

6.3 Vulnerability to Specific Hazards

This section details vulnerability to specific hazards, where quantifiable, only where it differs from that of the Region. The results of detailed GIS analyses used to estimate potential for future losses are presented here, in addition to maps of hazard areas and details by jurisdiction and building type. For a discussion of the methodology used to develop the loss estimates refer to Chapter 4 of the base plan. In many cases Chapter 4 contains information that differentiates the risk by county thus the information is not duplicated here. For most of the weather-related hazards the risk does not vary significantly enough from the rest of the Region and thus the reader should refer to Chapter 4. Only unique issues or vulnerabilities are discussed, where applicable.

6.3.1 Avalanche

Avalanches affect a limited spatial area in the Region and are even less significant in Fremont County since most avalanches occur in the western part of the State along the Teton Range. There are no known critical facilities in avalanche prone areas, and buildings/infrastructure are scarce in the more mountainous/rural areas of Fremont County. The primary risk associated with this hazard is related to public safety. Avalanches affect a small number of people, such as snowboarders, skiers, and hikers, who venture into backcountry areas during or after winter storms. However, Fremont does have an extensive list of outdoor recreation opportunities, and many residents and visitors will continue to be exposed to avalanche hazards in mountainous areas. The overall significance of this hazard is low across the County and does not vary between the jurisdictions.

6.3.2 Dam Failure

There are thirteen high hazard dams and six significant hazard dams located upstream from population centers in Fremont County. The table below identifies the dams and the affected communities (participating in this plan).

Table 20 High and Significant Level Dams in Fremont County by Jurisdiction

Hazard Level	Dam Name	Nearby City
High	Enterprise	Lander
High	Pilot Butte	Riverton
High	Pilot Butte Embankment 3	Riverton
High	Pilot Butte Embankment 2	Riverton
High	Ray Lake	Lander
High	Bull Lake	Riverton
High	Worthen Meadows	Lander
Significant	Christina	Lander
Significant	Grandy	Dubois

With nine high or significant hazard dams in the planning area, dam failure could cause flooding in the future.

- Of the County's jurisdictions, Lander and Riverton are at increased risk. In particular, the Pilot Butte Embankment dams (3 total) are of concern due to the proximity to Riverton. The HMPC also noted areas above Bull Lake that are more vulnerable.

6.3.3 Drought

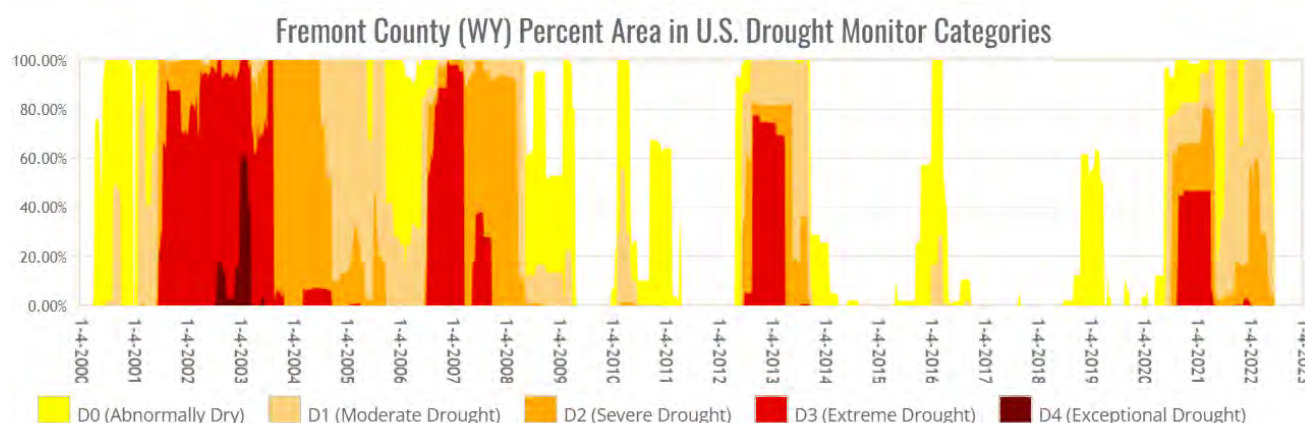
Like the rest of the Region, drought is a high-significance hazard for the County. Since 2012 there have been 15 USDA Disaster Designations in Fremont County for drought. According to the U.S. Drought Monitor records for Fremont County, in the 1,147-week period from 2000 through 2021, the county spent 890 weeks (78% of the time) in Abnormally Dry (D0) conditions. Approximately 57% of the time, or 658 weeks, was spent in Moderate Drought (D1) conditions. Weeks in drought between 2000 and 2020 are summarized in Table 21 and shown in time series from January 2000 and May 31, 2022, in Figure 3.

Table 21 Fremont County Weeks in Drought by Intensity, 2000-2021

Category	Description	Palmer Drought Severity Index (PDSI)	Standardized Precipitation Index (SPI)	Fremont County Weeks in Drought, 2000-2021
D0	Abnormally Dry	-1.0 to -1.9	-0.5 to -0.7	890
D1	Moderate Drought	-2.0 to -2.9	-0.8 to -1.2	658
D2	Severe Drought	-3.0 to -3.9	-1.3 to -1.5	505
D3	Extreme Drought	-4.0 to -4.9	-1.6 to -1.9	318
D4	Exceptional Drought	-5.0 or less	-2.0 or less	47

Source: U.S. Drought Monitor

Figure 3 Fremont County Drought Intensity, 2000-May 31, 2022



Source: U.S. Drought Monitor

Vulnerability is tempered somewhat by the County being a headwaters area. The snowpack in the Wind River Range helps feed rivers, lakes and streams during normal years, but can be affected by dry, low snowpack years. Drought-related impacts to the local economy can be extensive to tourism and industry from increased wildfire danger, forest closures and fire bans.

The overall significance of drought is consistently high throughout Fremont County and across jurisdictions. Wortham Meadow Dam provides part of the City of Lander's water supply. Refer to the Chapter 4 in the Base Plan for additional discussion of drought risk related to the Region and the County.

6.3.4 Earthquake

Fremont County has a long history of earthquakes, some of which have caused property damage. Most earthquakes experienced in the County are not felt by anyone due to a combination of the sparse population and the magnitude of the earthquake.

- Multiple earthquakes occur each year in the Beaver Rim or Jeffrey City.
- A hot spring is located near Ft. Washakie (this is in conjunction with hot springs located in Hot Springs County to the north of Fremont County.)
- There are numerous active fault lines located in Fremont County. The South Granite Mountain fault system is located in southeastern Fremont County and northwestern Carbon County. The fault system is composed of several west-northwest-trending faults that border the northern flanks of the Seminoe Mountains, Ferris Mountain, Green Mountain, and Crooks Mountain. The Stagner Creek fault system is an east-west trending system near Boysen Reservoir on the Owl Creek uplift's south flank. The Cedar Ridge/Dry Fork fault system is present in northeastern Fremont County and northwestern Natrona County. For these fault systems, the maximum credible earthquakes are determined to be between a magnitude of 6.5 and 6.75.
- Arapahoe, Dubois, Hudson, Lander, Pavillion, Riverton, and Shoshoni are all listed within intensity VII earthquake areas. In intensity VII earthquakes, damage is negligible in buildings of good design and construction, slight-to-moderate in well-built ordinary structures, considerable in poorly built or badly designed structures such as un-reinforced masonry buildings. Some chimneys will be broken.
- It is estimated that in a 2,500-year earthquake event (2% probability of being exceeded in 50 years), Fremont County would sustain \$137 million in total losses. In this scenario, Fremont County is ranked 6th in Wyoming when comparing damages and fatalities across the State. More detailed data analysis regarding HAZUS scenario results, exposure, and earthquake vulnerability is outlined in Chapter 4 of the base plan.

Over thirty magnitude 2.0 or intensity III and greater earthquakes have been recorded in Fremont County. The following paragraphs describe several past events of note, either because they caused damage or were significant enough to be noticeable, which occurred in Fremont County:

The first earthquake that was reported in Fremont County occurred on December 10, 1873. This earthquake, which was located in the southern part of the county near Atlantic City, was felt as an intensity III event at nearby Camp Stambaugh. On January 22, 1889, an intensity III-IV earthquake was reported near Lander. An intensity IV earthquake also occurred in the Lander area on November 21, 1895. People reported that houses were jarred and dishes rattled.

On August 11, 1916, an earthquake occurred in the Sand Draw/Gas Hills area. No damage was reported from this intensity III event, which was centered approximately 6 miles south of Jeffrey City.

Two earthquakes were reported in Fremont County in the 1920s. The first occurred on December 12, 1923, when an intensity V earthquake was detected approximately three miles west-northwest of Atlantic City. No significant damage was reported. This area experienced another non-damaging, intensity III earthquake on October 30, 1925.

Only one earthquake was reported in the county in the 1930s. On November 23, 1934, an intensity V earthquake was reported approximately 20 miles northwest of Lander. Residents in a 10-mile radius around Lander reported that dishes were thrown from cupboards and pictures fell from walls. Buildings in two business blocks were cracked, and the brick chimney of the Fremont County Courthouse was moved two inches away from the building. The earthquake was felt as far away as Rock Springs and Green River.

No earthquakes were reported in Fremont County in the 1940s, but several were reported in the county in the 1950s. On August 17, 1950, an intensity IV earthquake occurred approximately 2.5 miles south-southeast of Lander. It caused loose objects to rattle and buildings to creak. Intensity II and intensity IV earthquakes occurred in the same area on January 11, 1954 and December 13, 1955, respectively. No damage was reported from either event. On August 22, 1959, an intensity IV earthquake was detected approximately 3.5

miles west-northwest of Atlantic City. No damage was associated with this earthquake. A few days later, an earthquake was recorded on August 25, 1959. This event, which was located just southeast of Fort Washakie, was later determined to be non-tectonic in origin.

On October 12, 1961, a small-magnitude earthquake was detected approximately seven miles northwest of Pavillion. Two earthquakes were recorded in northern Fremont County on April 26, 1967. A magnitude 4.7 event and a magnitude 4.2 event occurred approximately 32 miles southwest and approximately 38 miles west-southwest of Thermopolis, respectively. No damage was associated with any of the earthquakes that occurred in the county in the 1960s.

Several earthquakes were reported in Fremont County in the 1970s. The first occurred on April 22, 1973, approximately 12 miles north of Jeffrey City. This magnitude 4.8, intensity V earthquake rattled dishes and disturbed pictures on walls in Jeffrey City. A small earthquake occurred on June 14, 1973, approximately eight miles east-northeast of Lander. This event was later determined to be the result of an explosion in the area. On March 25, 1975, a magnitude 4.8, intensity II earthquake was detected approximately 18 miles northwest of Jeffrey City. A mobile home located 35 miles southeast of Riverton was moved an inch off its foundation by this earthquake. A magnitude 3.5 earthquake occurred on December 19, 1975, approximately 25 miles northeast of Jeffrey City. This earthquake did not cause any damage. Later that same month, on December 30, 1975, an earthquake of no specific magnitude or intensity was recorded in eastern Fremont County, approximately 27 miles east-southeast of Riverton. No one reported feeling this event.

Four earthquakes were reported in the county in the 1980s. On January 28, 1980, a magnitude 2.8 earthquake was recorded in the northwestern part of the county, approximately 28 miles northwest of Dubois. This earthquake was not felt. A magnitude 3.1 earthquake occurred on September 4, 1980, approximately 15 miles west-southwest of Atlantic City. No damage was reported. A magnitude 3.2, intensity IV earthquake occurred in Fremont County on August 31, 1982. No significant damage was reported from this earthquake, which was centered approximately 10 miles southwest of Lander. On November 3, 1984, a magnitude 5.1, intensity VI earthquake was detected approximately 10 miles northwest of Atlantic City. The earthquake was felt in Lander, Dubois, Atlantic City, and Casper. Residents in Lander and Atlantic City reported cracked walls, foundations, and windows. This event was one of the largest earthquakes to occur in the southwestern quarter of the state. The last earthquake to occur in Fremont County in the 1980s took place on August 16, 1985. This magnitude 4.3, intensity IV event occurred approximately 25 miles southeast of Jeffrey City. No damage was associated with this earthquake.

On August 7, 1991, a magnitude 3.5 earthquake was recorded in northern Fremont County, approximately 35 miles southwest of Thermopolis. Residents of Thermopolis reported feeling this non-damaging earthquake. Another non-damaging earthquake occurred on January 31, 1992, approximately 20 miles northwest of Lander. Area residents reported feeling this magnitude 2.8 event. On October 10, 1992, a magnitude 4.0, intensity III earthquake was detected approximately 22 miles east of Lander. Again, people in the area felt this earthquake, but no damage was reported from it. A magnitude 3.8, intensity III earthquake occurred near Bairoil on June 1, 1993, approximately 17 miles southeast of Jeffrey City. No damage was reported. On August 22, 1993, a magnitude 3.1 earthquake was recorded in northwestern Fremont County, approximately 14 miles west-northwest of Dubois. No one reported feeling this earthquake. A magnitude 3.4 earthquake occurred approximately 11 miles southeast of Jeffrey City on December 11, 1996. Again, no damage was associated with this earthquake. This earthquake was followed by another non-damaging, magnitude 3.1 event on April 25, 1997. No one felt this earthquake that was centered approximately 10 miles south of Lander. Lander city officials reported, however, that the earthquake may have caused a crack in the city's water tank, releasing 600,000 gallons of water. On July 21,

1999, another magnitude 3.1 earthquake occurred approximately 23 miles southeast of Lander. No one reported feeling this event.

On August 19, 2000, an earthquake was reported approximately 25 miles west-northwest of Jeffrey City. Area residents reported feeling this magnitude 3.2 earthquake. Most recently, a magnitude 3.0 earthquake occurred on November 8, 2000, in northeastern Fremont County. This event was centered approximately 29.5 miles southeast of Thermopolis. No one reported feeling this earthquake.

6.3.5 Expansive Soils

The Fremont County HMPC stated that there were no known issues of expansive soils in the County, but that they were aware of areas where expansive soils occur, including north of Riverton. Potential for swelling is predominantly moderate for the County and associated impacts are negligible. While there are areas of potential risk that are identified, the Fremont HMPC indicated that this hazard presents little to no impact. Overall, expansive soils are a low significance hazard across the County. Lander and the unincorporated areas around the Lander Valley area are slightly more vulnerable to and the map included in Chapter 4 of the base plan identifies areas where the soil has a moderate risk of expansion. The chapter also includes more information on the location of various soil types, probability of expansion, and exposed building values.

6.3.6 Extreme Cold

Based on data provided by the Fremont HMPC and historical records, extreme cold is an annual occurrence for the County. Though the probability of this event is highly likely, damages or lives lost occur less often. However, extreme cold can cause a problem for utility infrastructure and communications, as well as livestock and crops. Since 2012 Fremont County has received 3 USDA Disaster Designations for freeze or frost. Between 2007 and 2021 frost, freeze and cold winters have caused 3,579 acres of crops to be lost resulting in \$749,576 in indemnity payments countywide. Average annual losses due to extreme cold is estimated to be \$53,541. There is always a risk to people, however, danger is higher for the elderly, children, people in poor health, or individuals living without adequate shelter/heating. The overall significance of this hazard is low across the County and does not vary between the jurisdictions. Refer to Chapter 4 of the base plan for more information.

6.3.7 Flood

Fremont County has a long history of flooding that has resulted in the loss of life and significant property destruction. Most recently, the jurisdictions experienced spring flooding caused by anomalously warm temperatures and strong winds that brought rapid snowmelt around portions of the Lander Foothills and Wind River Basin. In addition, the frozen Little Popo Agie and Popo Agie rivers broke up rapidly and ice jams caused flooding in areas of the Lyons Valley. The result was \$15,920,00 in property damage and \$780,000 in crop damages between Hudson, Riverton, and Lander. However, in terms of damages, the most devastating event occurred in 2010, when overland flooding and high velocity water flows resulted in a Presidential Disaster Declaration DR-1923-WY. At the height of the event 32 square miles were affected in the flooded area. Structural damage during this event is estimated to be \$12 million reported by National Environmental Satellite, Data and Information Service (NESDIS). Approximately 150 farms were damaged with estimates being over \$2 million dollars (Fremont County Emergency Board, 2010).

GIS analysis was used to estimate Region 5's potential property and economic losses during the 2022 update, see Section 4.2.5 in the base plan for specifics and results. In the event of a 100-year flood (1% annual chance), most impacted buildings are in the unincorporated areas (79.38%), followed by Dubois (8.46%), Hudson (7.38%), Lander (3.85%), and Riverton (0.92%).

Figure 4 Fremont County FEMA and Hazus Flood Hazards

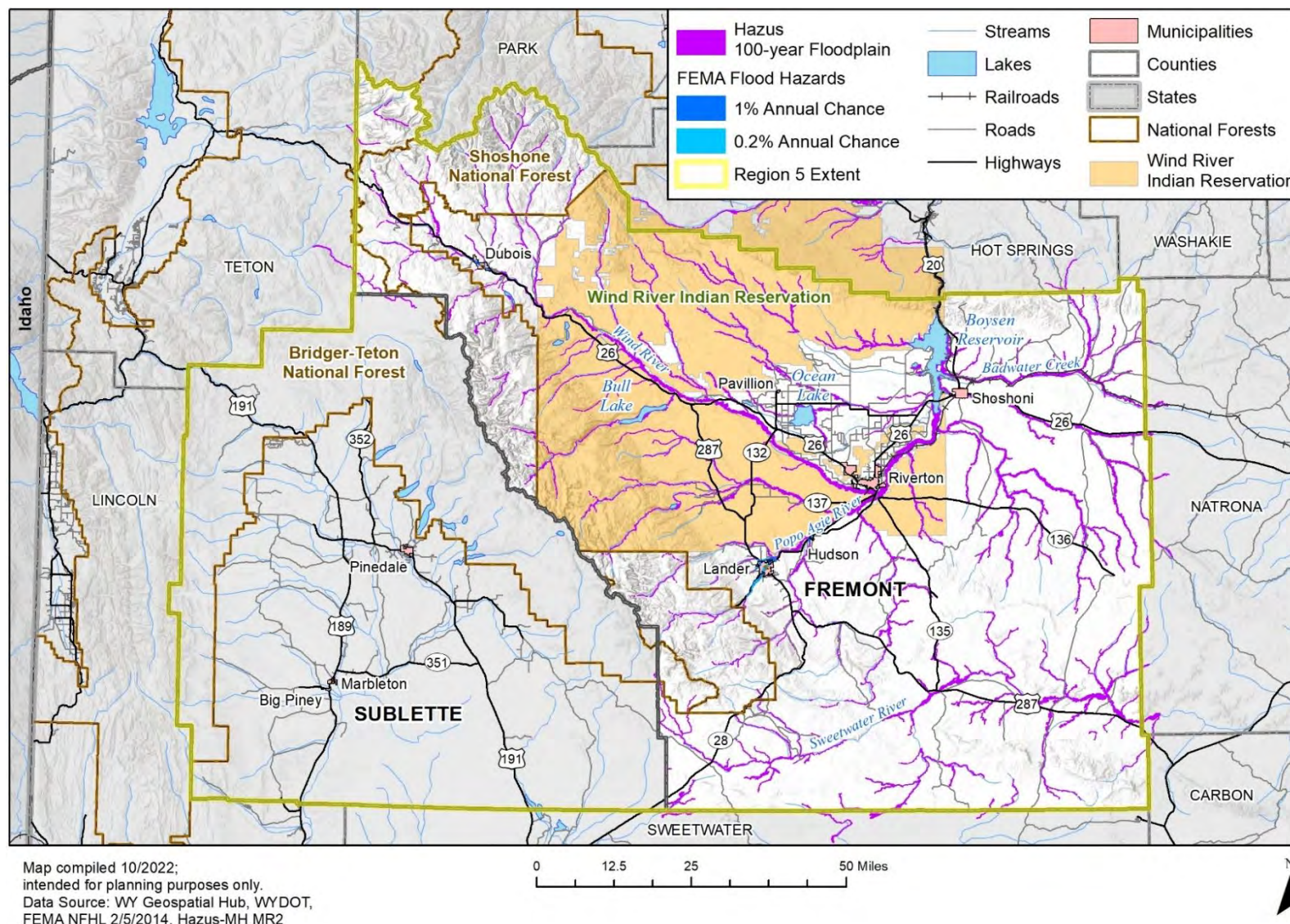


Figure 5 **Dubois FEMA and Hazus Flood Hazards**

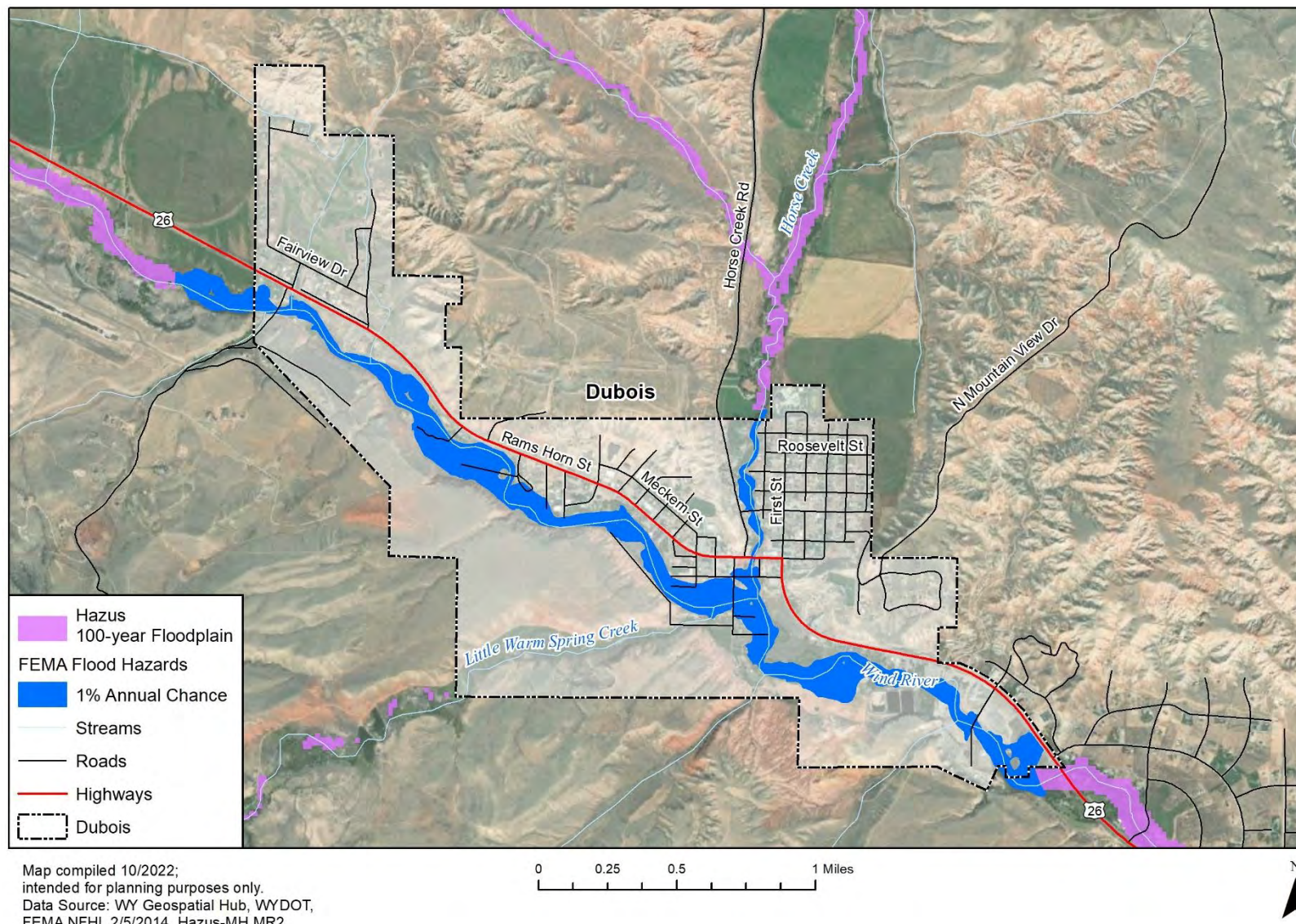


Figure 6 Hudson FEMA and Hazus Flood Hazards

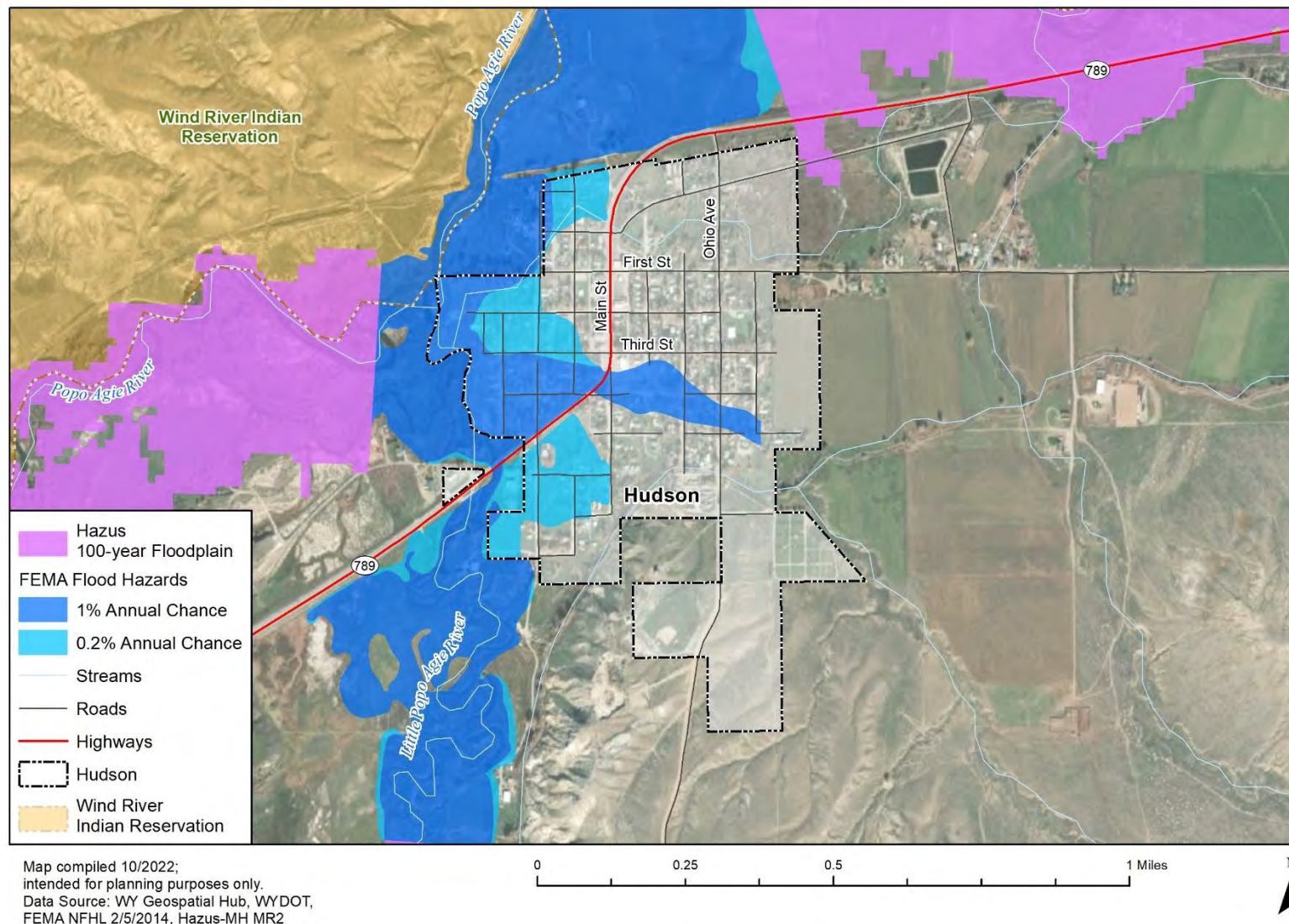


Figure 7 Lander FEMA and Hazus Flood Hazards

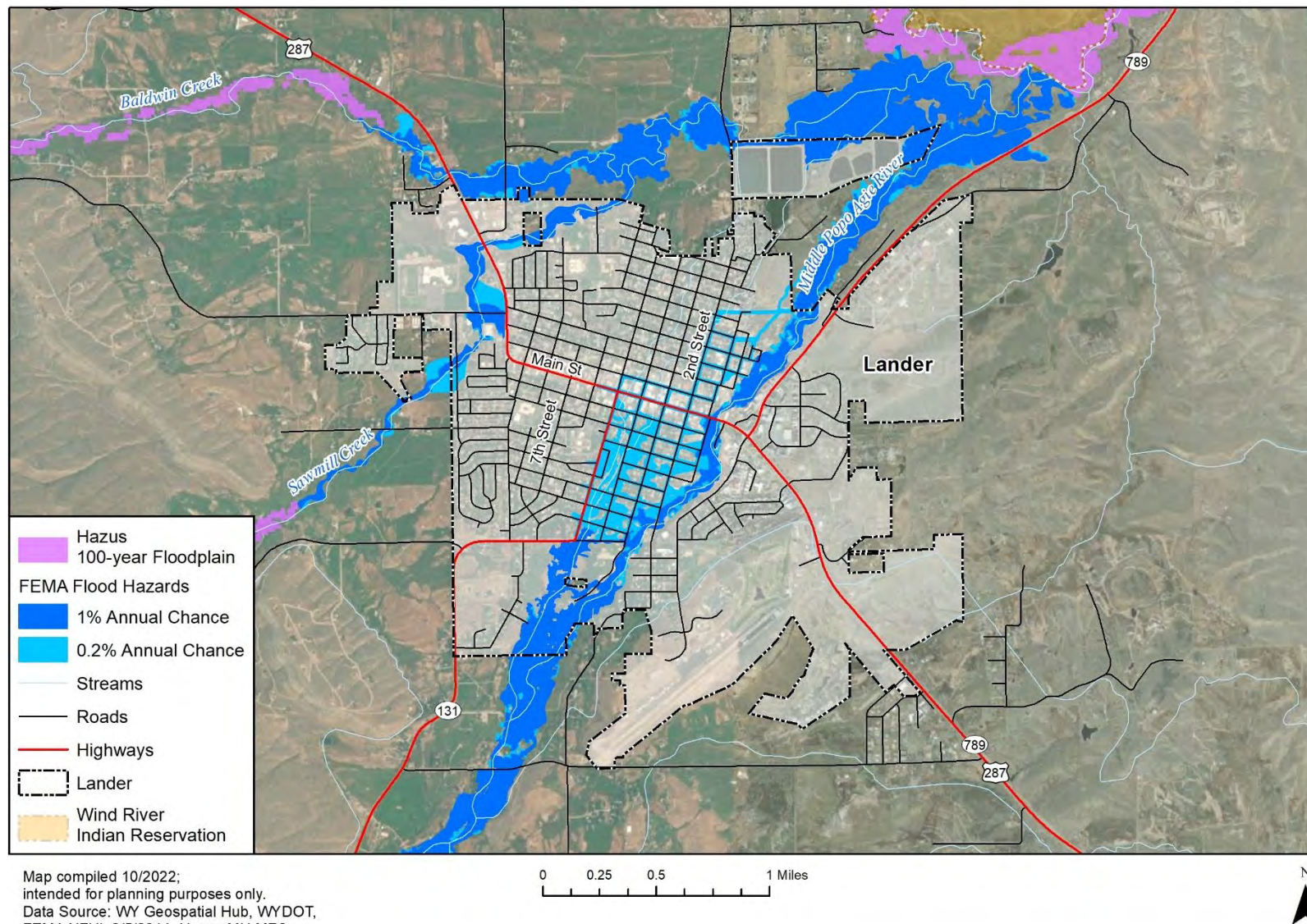
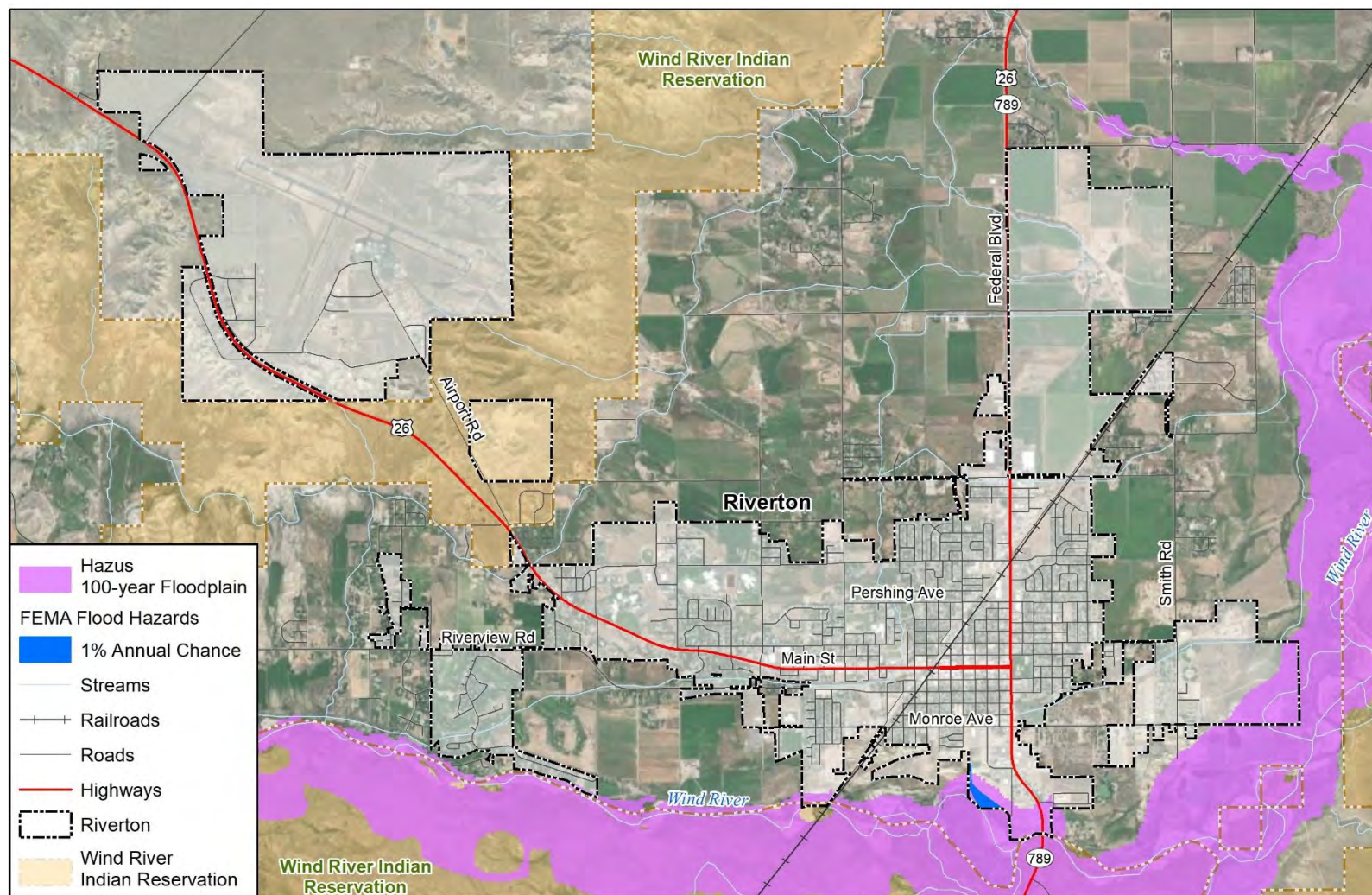
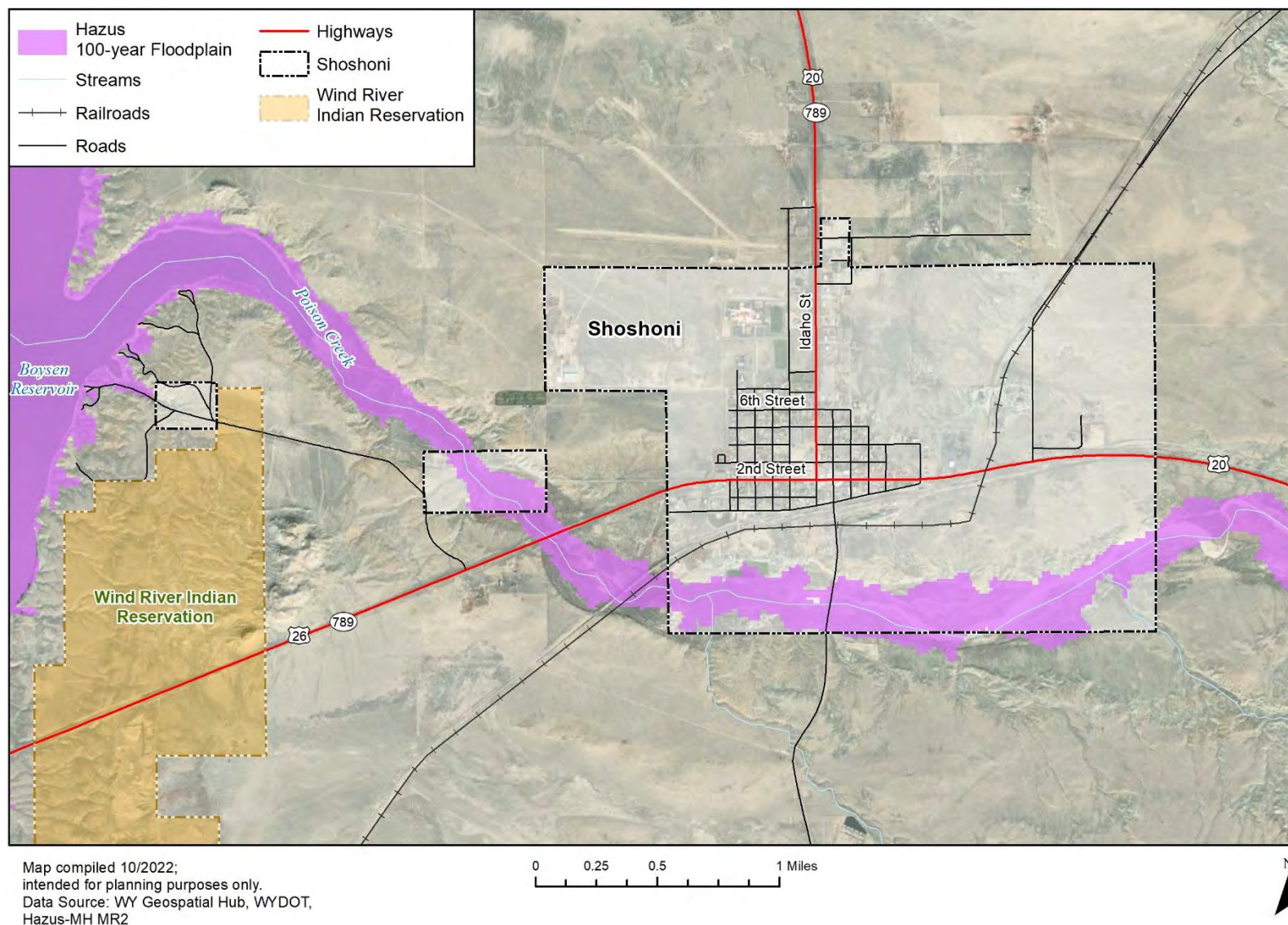


Figure 8 Riverton FEMA and Hazus Flood Hazards



Map compiled 10/2022;
intended for planning purposes only.
Data Source: WY Geospatial Hub, WYDOT,
FEMA NFHL 2/5/2014, Hazus-MH MR2

Figure 9 Shoshoni Hazus Flood Hazards



6.3.8 Hail

Hailstorms occur sporadically throughout Region 5, and primarily impact buildings and agriculture. Most of the damage associated with this hazard is related to crops, though there is potential for significant structural destruction from particularly large hailstones. Out of the 112 hail events reported in the planning area, 98 were in Fremont County. Additionally, all hail events with reported damage in the region was in Fremont County, which totaled \$25,500. The USDA reported crop damage due to hail in the planning area. All 35 events reported were in Fremont County, totaling 3,729 net acres lost and \$608,226 in damages. The Fremont County HMPC noted an event in 2015 which reportedly stripped an alfalfa field. Hail events in Fremont County have also caused roof damage in Lander and Riverton. Additionally, a hail event in August of 2019 produced ping-pong sized hail and caused damage to vehicles.

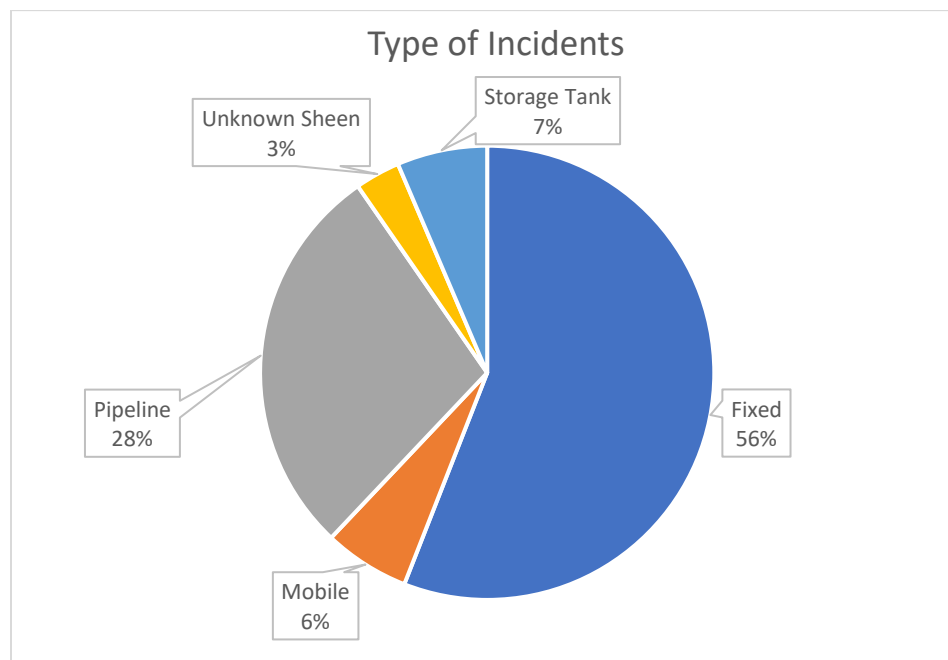
The probability of future occurrence for this event is likely, but the magnitude of these events is limited. Overall, hail poses a medium threat across the County and does not vary between the jurisdictions. Though it should be noted that property damage will be higher in the municipalities due to the concentration of built infrastructure, potential crop damage would be concentrated in the rural unincorporated areas. See Chapter 4 of the base plan for more information on the previously recorded hail events and associated damages.

6.3.9 Hazardous Materials

According to the National Response Center (NRC), Right-to-Know network database, there are five facilities in Fremont County required to generate a Risk Management Plan. There are also multiple oil and gas pipelines across the county.

According to the NRC database between 1990 and 2021, there have been 311 hazardous materials incidents in Fremont County. Fixed facilities were the most common incident type followed by pipeline incidents.

Figure 10 Hazardous Materials Incidents Reported to NRC by Type – Fremont County, 1990-2021



Source: NRC

In 2008, the LEPC reviewed and updated an emergency action plan that addresses hazardous materials and how they will be handled in Fremont County. This plan is adopted each year during the spring meeting. The Hazardous Materials plan is due to be updated beginning in 2023, this could take up to one year. To support response efforts, there is also a Regional Emergency Response Team composed of Fremont and Sublette Counties.

Refer to Chapter 4 of the base plan for a discussion of hazardous materials risk in the Region and County.

6.3.10 High Winds and Downbursts

Wind is a constant presence in Wyoming and the Fremont HMPC noted that high winds are a consistent issue for the County. It is difficult to assess vulnerability as it relates to location because damaging winds have occurred everywhere in the Region. The main risks associated with high wind events are related to poorly constructed buildings, flying debris, car accidents, and damage to electrical/power infrastructure. High wind events are often random and damages from high winds are often described in a regional context, though downbursts occur in smaller extents.

Wind damage reported in Fremont County totaled over \$1.3 million in property damages, with several of the most severe events occurring in Lander and Riverton. There are 450 days with reported severe wind events in Fremont County since 1964. The most damaging wind event in the planning area was recorded in Lander in Fremont County. The event took place in March of 1999, with estimated \$500,000 in damages to trees, automobiles, roofs, and other property. The max wind speed in the planning area was also recorded in Fremont County, with documented speeds reaching 126.6 mph. All \$114,105 of crop damage and 658.8 net acres lost from severe wind events in the planning area were recorded in Fremont County.

The probability of future occurrence for this event is likely, but the magnitude of these events is negligible. Overall, high winds pose a medium threat across the County and do not vary between the jurisdictions. See Chapter 4 of the base plan for more information on wind zones, events, and impacts.

6.3.11 Landslide/Debris Flow/Rockfall

The geologic history and unique conditions of Wyoming make landslides one of the most common hazards. In Fremont County, landslide deposits are highly concentrated in the northwestern portion of the County.

- The primary area of concern is along Highway US-26/287. Hwy 26 is the most direct route for accessing the Grand Teton National Park from central and southeastern Wyoming.
- In 2005, WYDOT identified a 21-mile segment along the roadway between Moran Junction and Dubois that needed major roadway improvements. Approximately 20 landslides were also observed within the outlined segment.

Numerous landslides are present in Fremont County. Specifically, landslides are present on the following quadrangles:

Antelope Ridge	Burris	Dishpan Butte
Bain Draw	Castle Rock	Dubois
Blue Gulch	Cottonwood Pass	
Blue Holes	Crater Lake	
Boysen	Crooks Mountain	
Bull Lake West	Crooks Peak	

East Fork Basin

Esmond Park	Mexican Pass
Fish Creek	Miners Delight
Fish Lake	Moccasin Lake
Fossil Hill	Mount Arter
Gas Hills	Ramshorn Peak
Gravel Spring	Sand Draw
Indian Point	Snow Lake
Kirkland Park	Split Rock NW
Kisinger Lakes	Torrey Lake
Lander	Warm Spring Mountain
Lava Mountain	Whiskey Peak
Mason Draw	Wiggins Peak
Maverick Springs	Wilderness
	Yellowstone Ranch

In terms of significance, landslides, debris flow, and rockfall vary based on the magnitude and the location. There is also a possibility that creeks or rivers within the County could become dammed by landslide activity, resulting in a flash flood hazard downstream if the landslide dam fails or is overtopped, or flood nearby developed areas as pooling behind the landslide dam occurs. While some events are, small and have limited impact on people and infrastructure, other occurrences can involve large sections of earth and may obstruct major roadways, power line corridors, or gas lines.

During the 2022 development of this regional plan a GIS analysis of exposure to landslide hazard areas was performed, with the results detailed in Chapter 4 of the base plan. Fremont County has a very high degree of landslide vulnerability, with 591 parcels or 17% of total parcels in the County located in the highest landslide susceptibility areas. Most of these vulnerable parcels are located in unincorporated areas of Fremont County. The geospatial distribution of landslide susceptibility can be seen on Figure 11 through Figure 16 .

Figure 11 Fremont County Landslide Hazard Areas

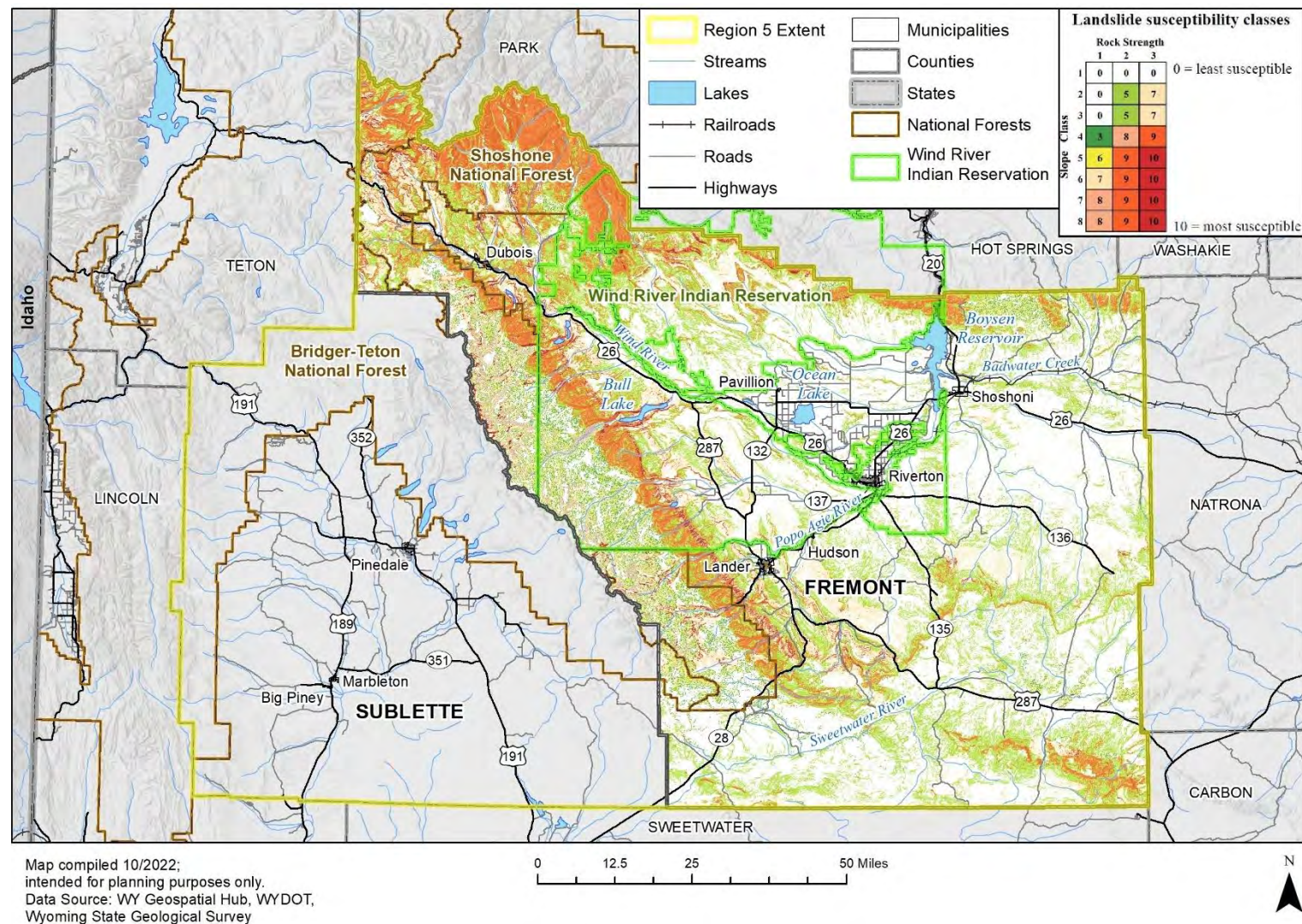


Figure 12 Town of Dubois Landslide Hazard Areas

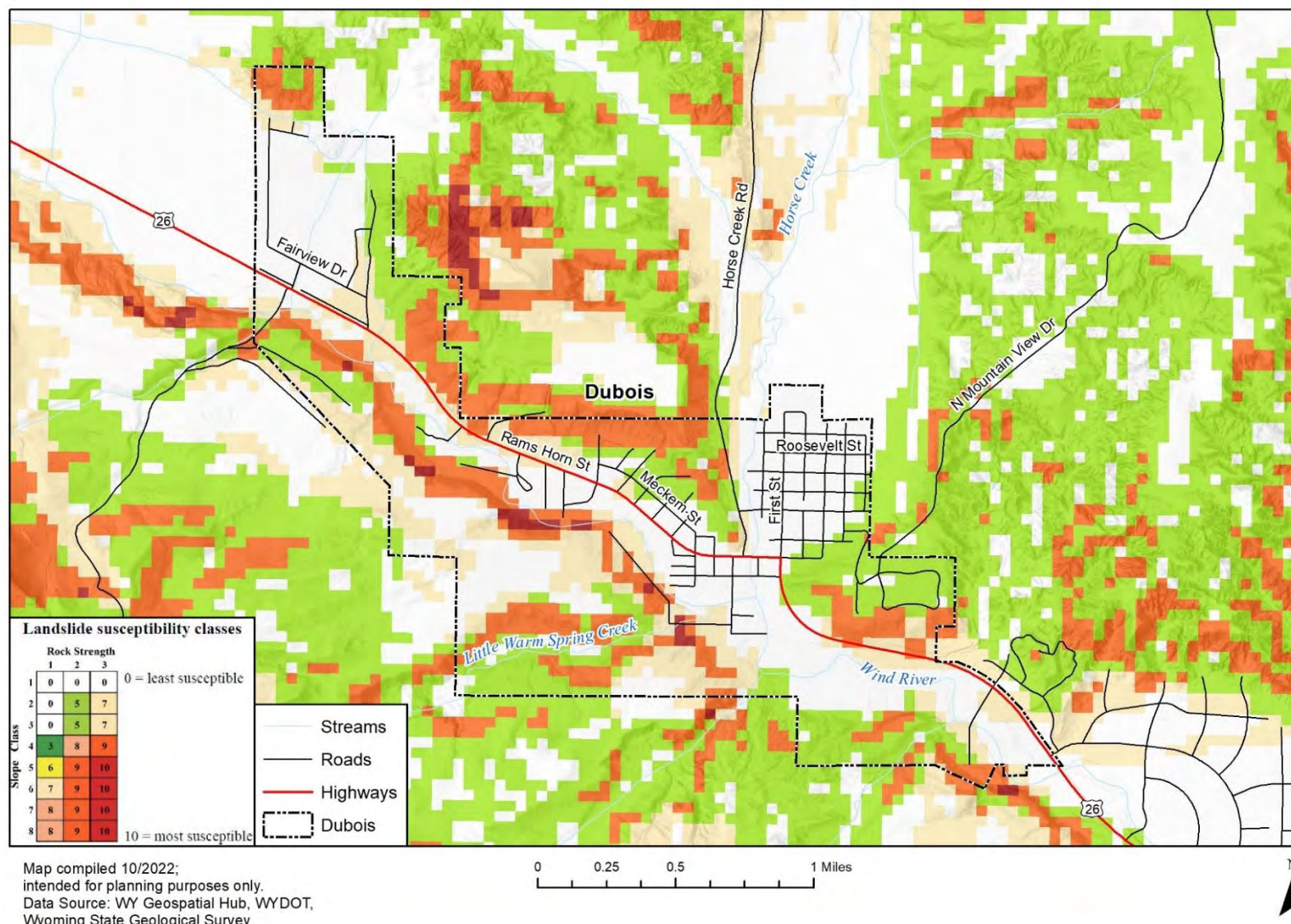


Figure 13 Town of Hudson Landslide Hazard Areas

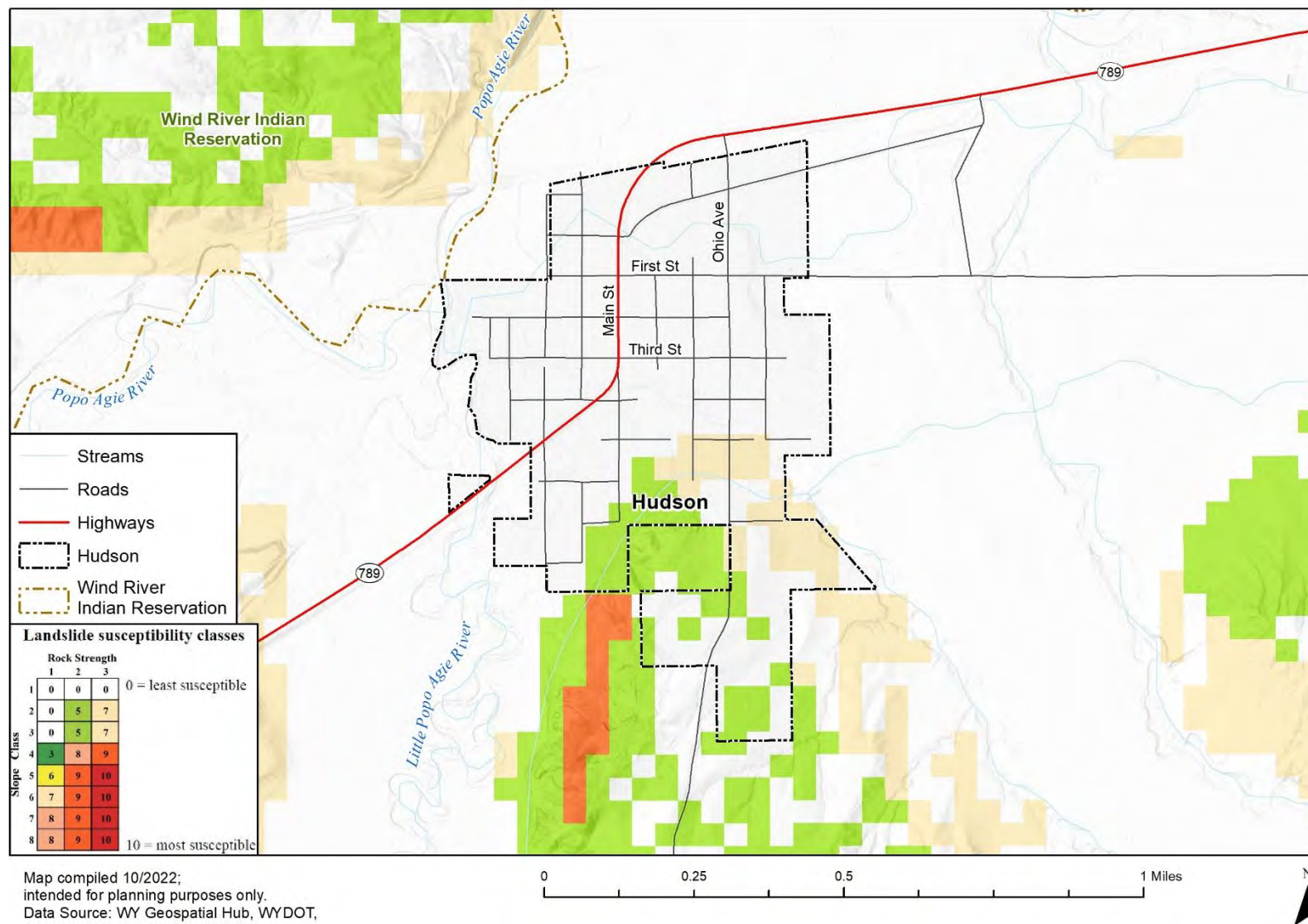


Figure 14 Town of Lander Landslide Hazard Areas

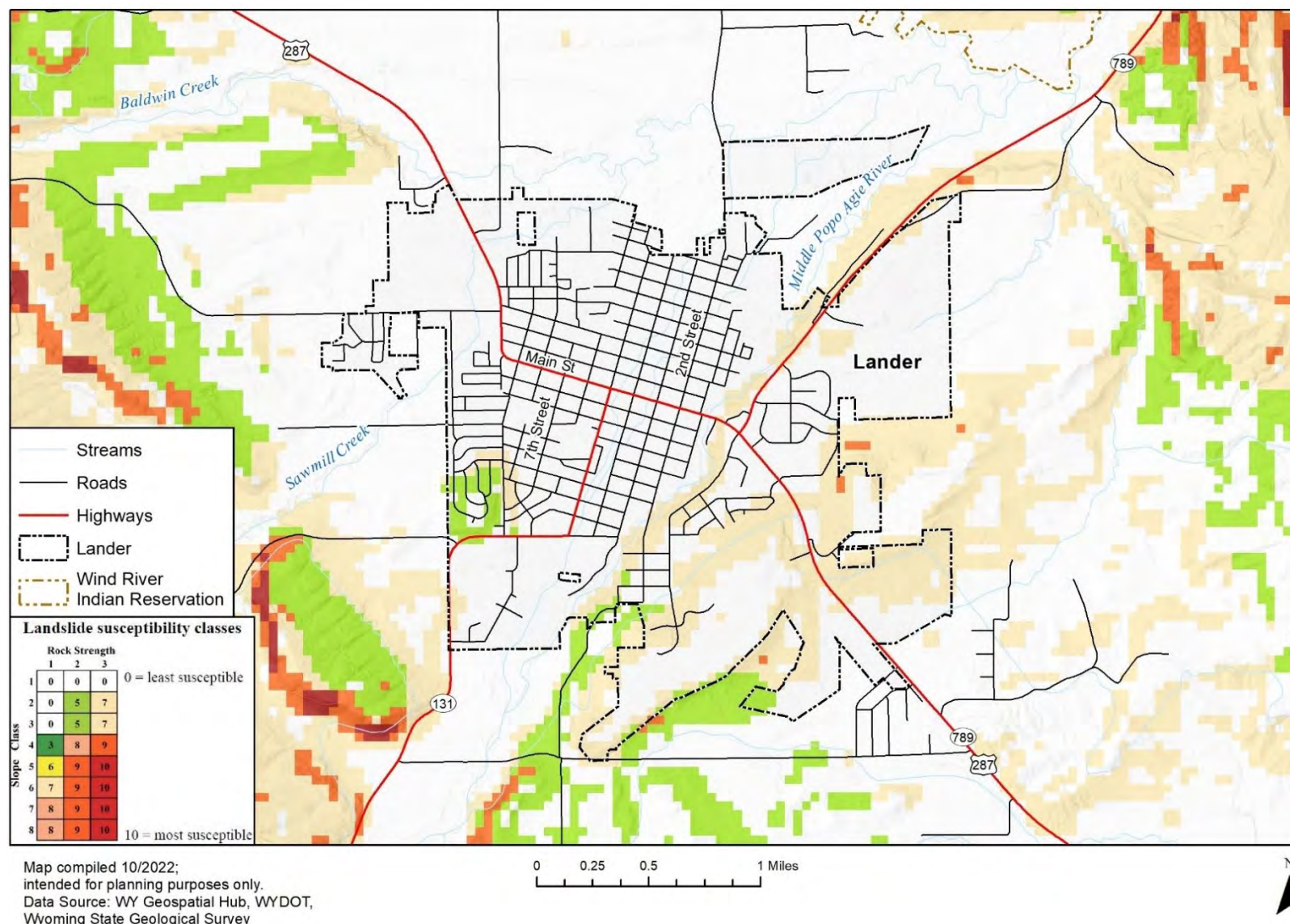


Figure 15 City of Riverton Landslide Hazard Areas

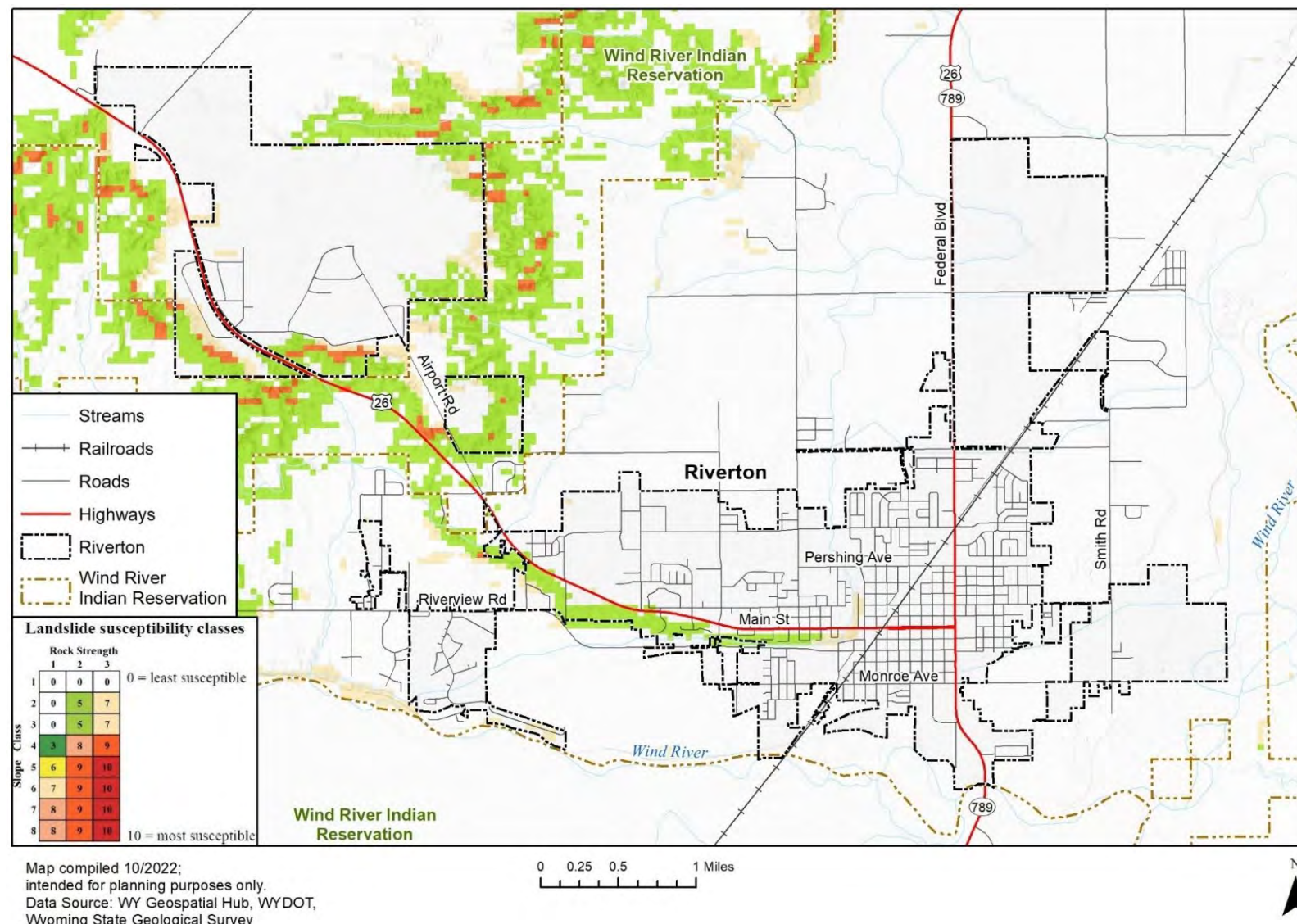
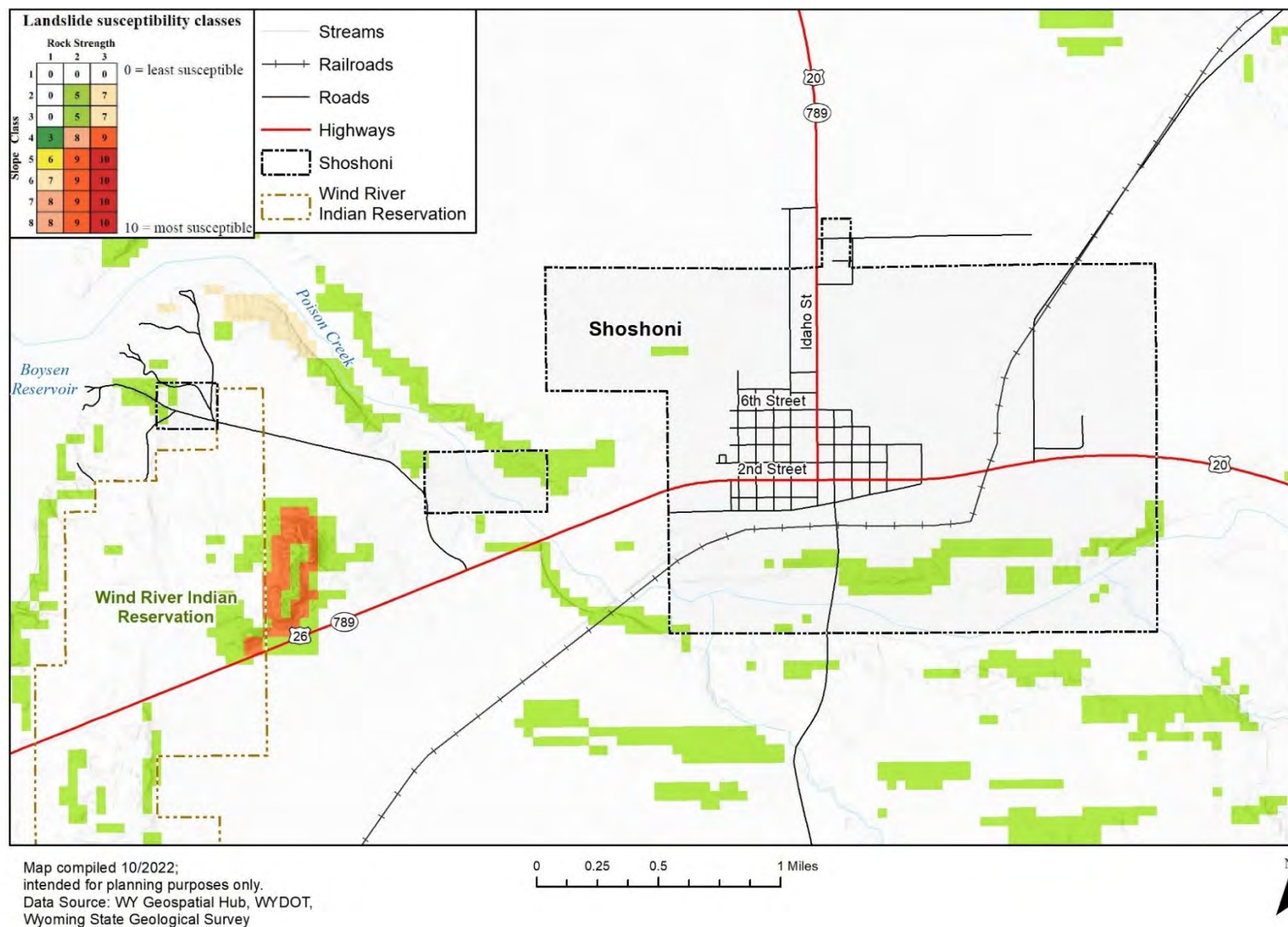


Figure 16 Town of Shoshoni Landslide Hazard Area



Future impacts are likely to affect transportation corridors, rivers, lakes and reservoirs, transmission lines, campgrounds and the occasional structure in the County. Historically, there has been damage associated with landslides in Lander, the Wind River Canyon, Dubois, the Beaver Rim Area, and the South Pass area.

6.3.12 Lightning

All areas in western Wyoming are susceptible to lightning strikes. Impacts to persons and property are likely to remain isolated. Outdoor workers and outdoor enthusiasts and livestock will remain susceptible to lightning strikes. The Fremont HMPC explained an event in Lander, where a substation was hit in 2016 and resulted in power outages for a few hours. Strikes have resulted in cattle deaths, sometimes 6-10 from one single strike.

Of the eight reported lightning events in the planning area since 1969, four occurred in Fremont County. Three of the four events that occurred in Fremont County caused monetary losses due to the lightning event. One of these damaging events occurred on June 13th, 2011, when lightning struck a home and sparked a fire. There were no fatalities or injuries, however, the entire home was destroyed and cost \$200,000 in damages.

Compared to the eastern portion of the State, Region 5 and the associated planning areas are three times less likely to experience cloud to ground lightning strikes. The most salient impacts associated with lightning events are the effects of loss of power or wildfire. The Fremont County HMPC noted that lightning events can be major issues for the power system with many surge arrestors on power lines. Structural fire and injuries/fatalities are less likely. The probability of future occurrences is highly likely across the County, but severity is limited. Overall, lightning poses a high threat across the County and does not vary between jurisdictions. See Chapter 4 of the base plan for more information on lightning events and impacts.

6.3.13 Mine Subsidence

There are numerous abandoned mine sites with subsidence-prone underground workings in Fremont County, especially in the southwestern and northeastern areas. Mines in the Region have been identified and there are mitigation projects designed to reduce the impacts from underground mining and subsidence, and to remove the threat they pose to the surrounding area. The unmitigated identified mines pose little to no threat to infrastructure in the surrounding area. Mine subsidence events occur occasionally, and the degree of risk and impact varies based on the characteristics of each mine. Refer to Chapter 4 of the base plan for a more detailed vulnerability assessment and location of abandoned mine sites. There are some areas near Hudson, but most are in the rural unincorporated areas.

6.3.14 Severe Winter Weather

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the State. Blizzard conditions bring the triple threat of heavy snowfall, strong winds and low temperatures. Poor visibility and huge snowdrifts are major hazards caused by blowing snow. These storms disrupt work, make travel difficult or impossible, isolate communities, kill livestock by the hundreds or thousands and sometimes leave human fatalities in their wake. In the Lander Valley and the foothills of the Wind River Mountains there is a condition which occurs referred to as an 'upslope' condition. Wind blows from the east to west against the foothills causing the moisture to rise the eastern slope of the mountain. This event can cause heavy snowfall in the Lander and Dubois areas and unincorporated areas in the foothills.

- According to the Fremont County 2012 Hazard Mitigation Plan, the largest snowstorm recorded since 1891 was on April 21-24, 1999, when Lander received 52.7 inches of snow during one event.
- The Fremont County HMPC noted an upslope event in April 1999 which reached 52' of snow in Lander which caused some roofs to collapse.

The overall significance of this hazard is high across the County and does not vary between the jurisdictions or the Region as a whole. Refer to Chapter 4 of the base plan for more information.

6.3.15 Tornado

Of the 26 tornado events reported by the NECI, 20 occurred in Fremont County. Many documented tornadoes occurring in the counties in Region 5 are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage. However, there have been 3 recorded F2 tornado events in Fremont County, as well as one F3 event. Fremont County has significantly more recorded tornado events compared to Sublette County, but the overall significance is still very low. Since 1950, there have been 20 recorded tornadoes in Fremont County, and of these events, there were four fatalities, no injuries, and no crop damages. Most property damages were accrued from two individual events in 1980 and 1986, where \$250,000 worth of damages were recorded, however, most events were associated with fewer damages (\$2,500-\$25,000 range). Overall, Fremont County accounted for \$627,530 (or 96%) of total damages in the planning area.

All property is vulnerable during tornado events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Mobile homes are more vulnerable to the impacts of a tornado event compared to other housing types due to methods of construction. Statewide, mobile homes represent about 13% of total housing compared to 6.1% Nationwide. Fremont County has a higher percentage of mobile homes as total housing compared to the statewide and national averages, with 15.9% of occupied housing units as mobile homes or other housing types.

Region 5 tornado events are very small in terms of magnitude, with limited associated impacts, and the low-level significance of this event does not vary across jurisdictions. See Chapter 4 of the base plan for more information on tornado events and impacts.

6.3.16 Wildfire

Fremont County has a long history of wildfire, as a significant portion of the county lies within national forest and the Wind River Range. The Federal Wildland Occurrence data records 914 total fire events with 553,846 total acres burned in Fremont County from 1980 to 2021. The largest fire in Fremont County occurred in 2002. The South Fork Fire burned 150,000 acres. The table below describes Fremont County wildfires that burned 1,000 or more acres between 1980 and 2021, sorted by size.

Table 22 Wildfires over 1,000 acres in Fremont County: 1980-2021

Name	Year	Acres Burned
South Fork	2002	150,000
Katesbasin	2000	137,069
Alpine Lake	2012	45,877
Alpine Lake	2012	45,877
Norton Point	2011	24,237
Norton Point	2011	24,237
Wise Flat	1988	22,000
Lava Mountain	2016	14,654
Pass Creek	2002	13,433
Bear Cub	2012	6,493
Nowlin	2011	4,425
Ann's	1989	3,477
Dinwoody	2001	2,432
Beaver Rim	2001	1,927

Name	Year	Acres Burned
Unit 40	1988	1,804
Burroughs	2013	1,782
Spring Mtn	2000	1,755
Fairfield	2013	1,545
Murphy Draw	2000	1,365
17 Mile #6	1994	1,344
Fairfield	2013	1,335
Red Canyon	2000	1,312
Washakie Park	2006	1,240
Stratton	1992	1,216
Little Bob Lake	2015	1,199
Cedar Butte Rx	2006	1,130
Wise Flat	2006	1,044

Source: Federal Wildland Occurrence Data

There have been no catastrophic urban fires documented in Fremont County although large wildland fires become increasingly damaging as the population expands into the more rural areas. The statewide Wildland Urban Interface Hazard Assessment and its resultant outputs serve two primary purposes: assisting in prioritizing and planning mitigation projects and creating a communications tool to which agencies can relate to common information and data. With the mapping analysis evaluating areas of varying wildfire vulnerability, the final output will result in a Risk, Hazard, and Value (RHV) map displaying areas of concern (Redzones) for catastrophic wildland fires.

Another method of estimating potential future impact is to determine the value of structures that are located within Wildfire Risk Areas, or wildland fire building exposure values. Wildland fire building exposure value is the value of buildings that can be potentially damaged by wildland fire in an area. Building exposure values are based on county assessor data. The methodology utilized is like that used to model flood exposure described in the flood chapter. Based on GIS analysis performed, Fremont County has almost \$1.5 billion in improved property value potentially at risk to wildland fires, and there are an estimated 19,731 people living in the wildfire risk areas. Though it is not likely that the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected. Future wildfires could damage crops and watersheds within the County and contribute to soil erosion and deposition problems.

The principal wildfire mitigation plan for Fremont County is the "Fremont County Community Wildfire Protection Plan" (Updated 2019). The CWPP identified thirty-four communities at risk, broken out along geographic areas. A community assessment was conducted during the CWPP development using a Fire Hazard Severity Scorecard based on the International Wildland-Urban Interface Code, combined with processes referenced in the Firewise Communities Publication Hazard Assessment Methodologies. Each community was given a high, moderate or low wildfire hazard rating, based on a number of factors including physical infrastructure, roads, fire behavior components such as fuels and topography, water supplies, available fire protection and local fire occurrences. The communities identified are listed below, grouped by their hazard severity rating. See the CWPP for additional descriptions of these communities and mitigation recommendations.

- **Low** – Jeffrey City, Lysite/Lost Cabin, Red Rocks, Shoshoni/Bonneville, South Pass City, Sweetwater Station, Arapahoe, Riverton, 17 Mile, Pavillion/Missouri Valley/North Portal/Hidden Valley
- **Moderate** – St. Stephens, Fort Washakie, Boulder Flats, Crowheart, Ethete, Lander, Johnstown/River Bottom, Atlantic City, Jakey's Fork, Warm Springs, Dubois

- **High** – Beaver Creek Area, Pine Creek, Homestead Park/Lander Mountain Road, Red Canyon, Pass Creek/Limestone, Warm Springs Mountain, Porcupine, Stoney Point, Upper Wind River, Dunoir, Crooked Creek, Warm Springs ULWS, Sinks Canyon

Figure 17 through Figure 21 below illustrate the wildfire risk to each of the incorporated communities in Fremont County in greater detail.

Figure 17 **Dubois Wildfire Risk**

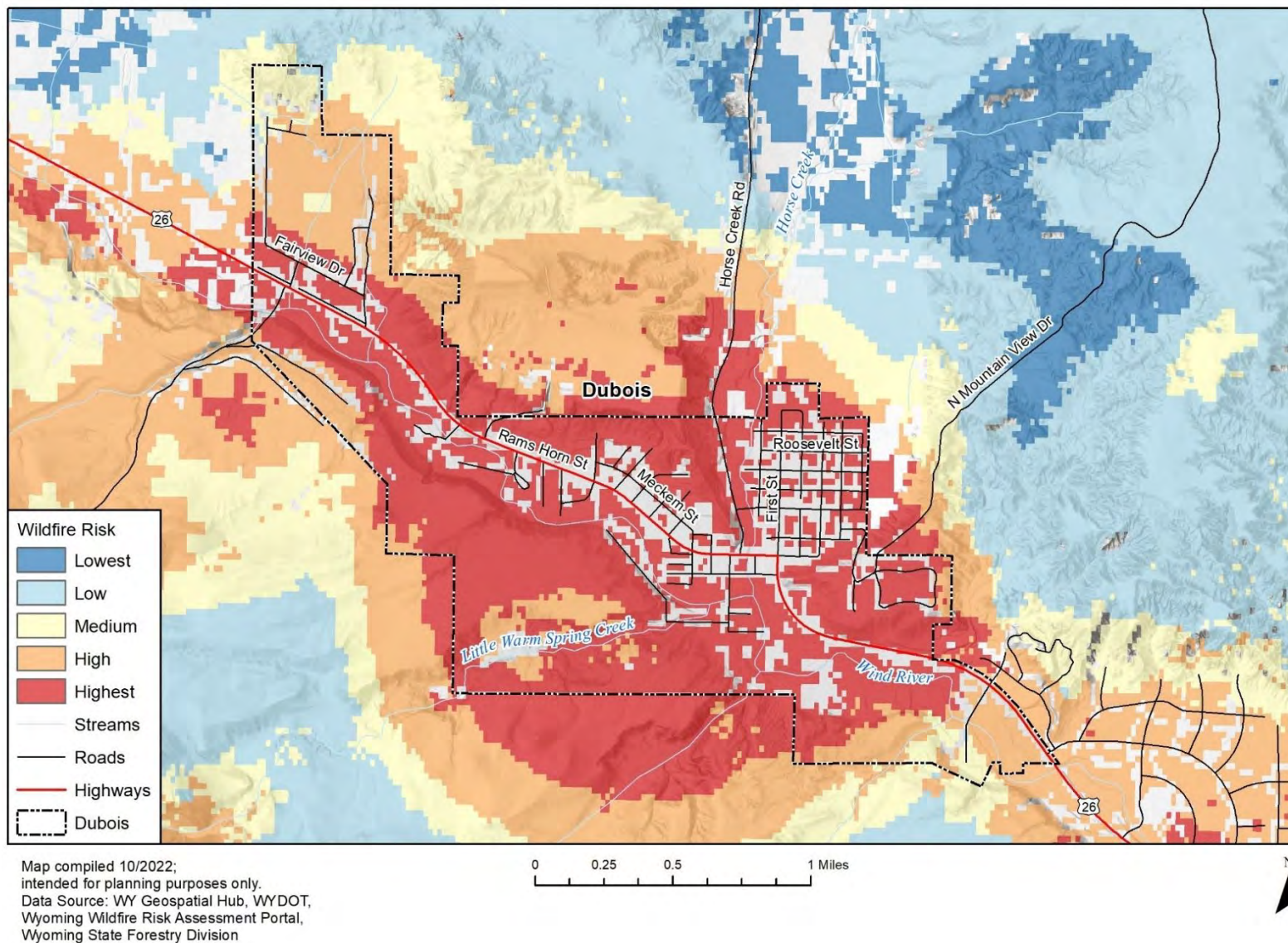


Figure 18 Hudson Wildfire Risk

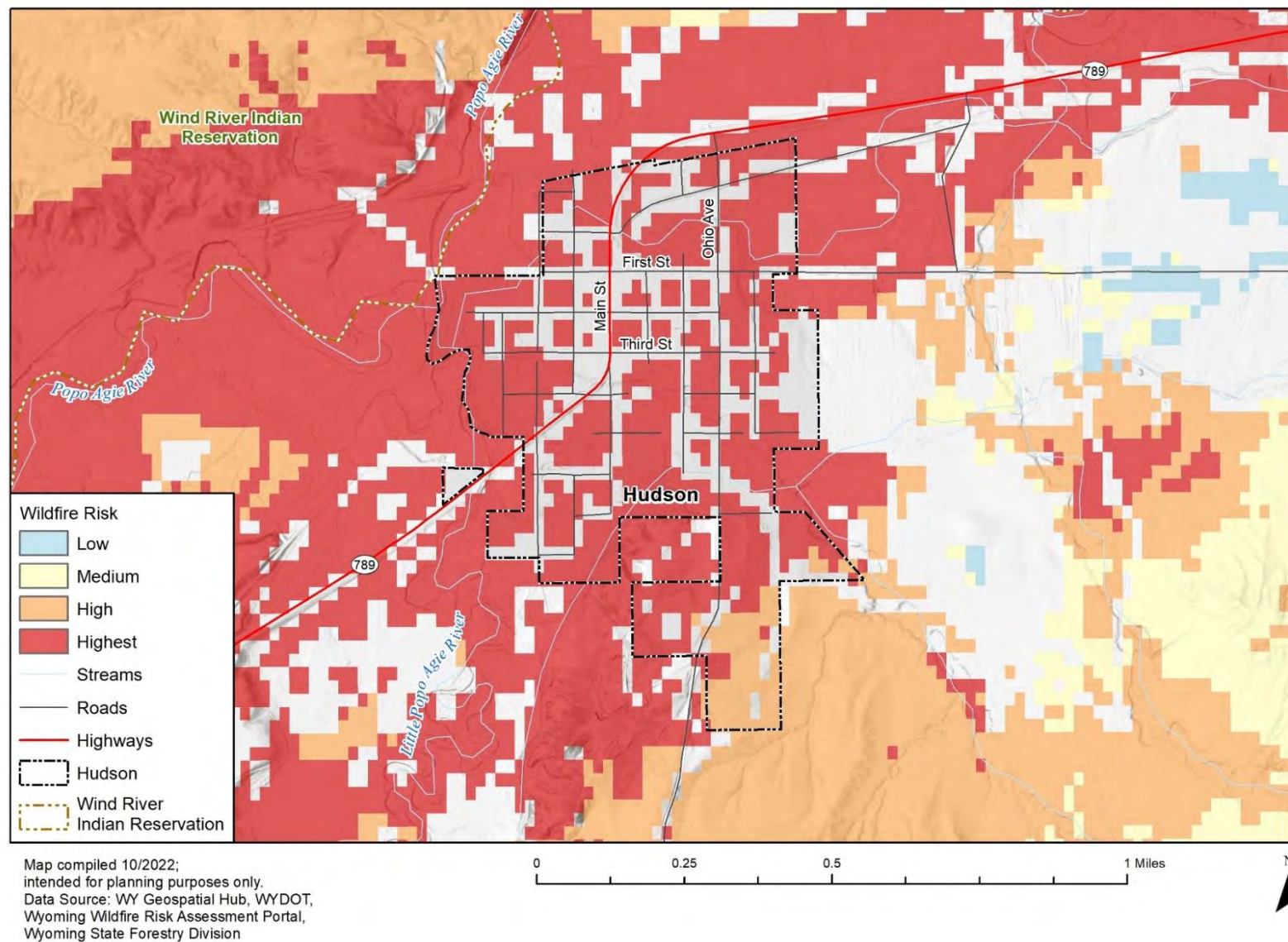


Figure 19 Lander Wildfire Risk

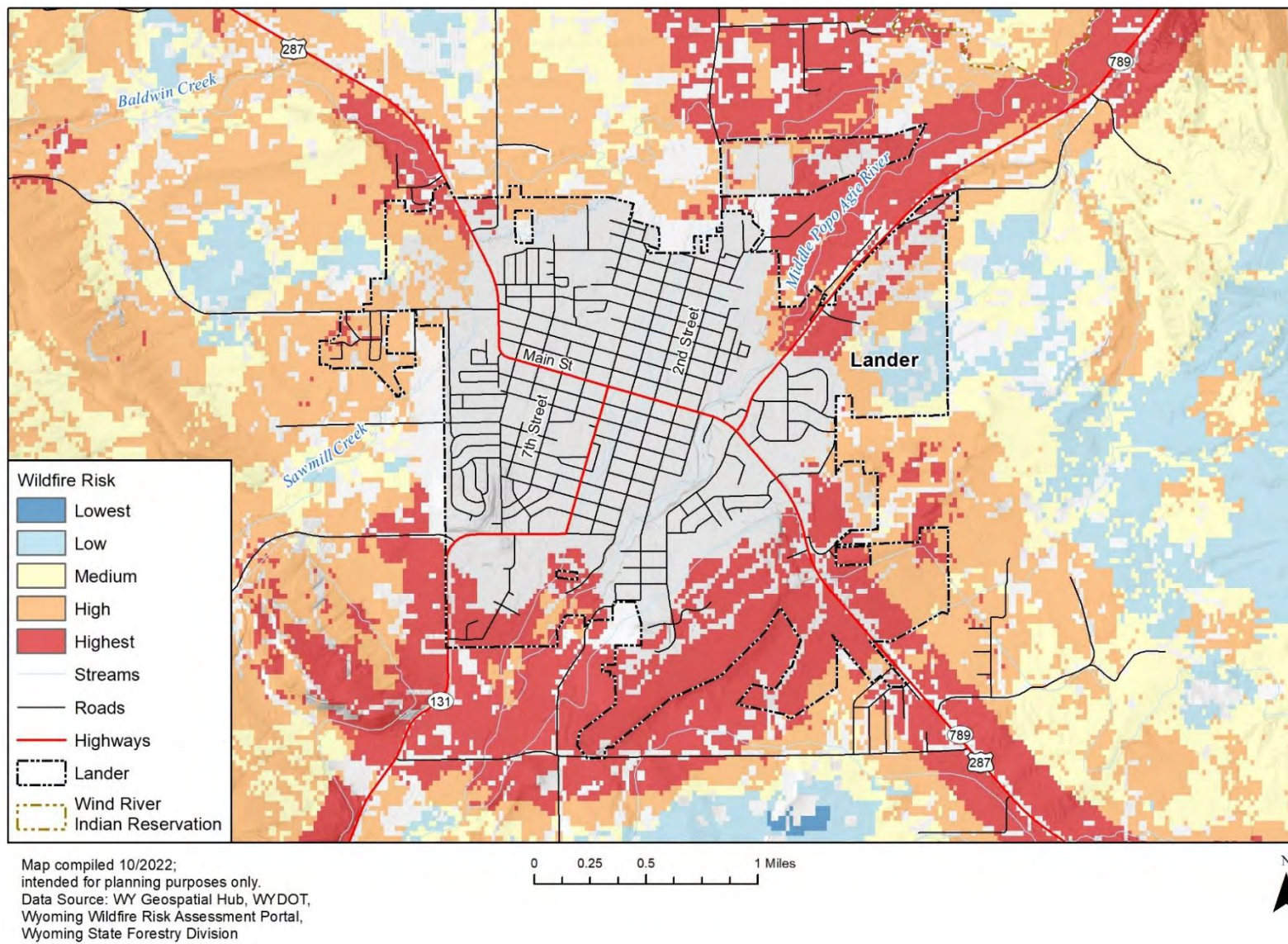


Figure 20 **Riverton Wildfire Risk**

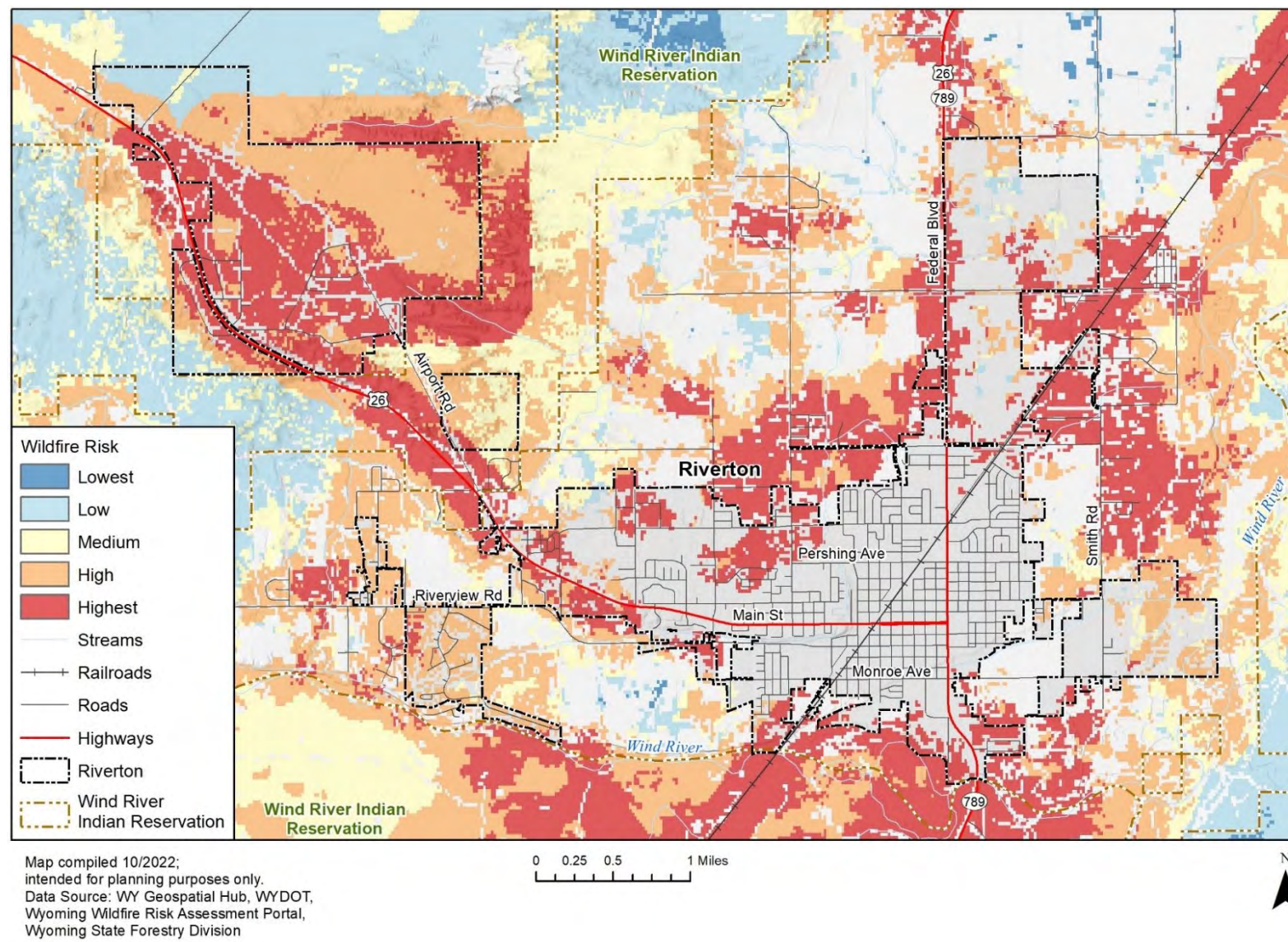
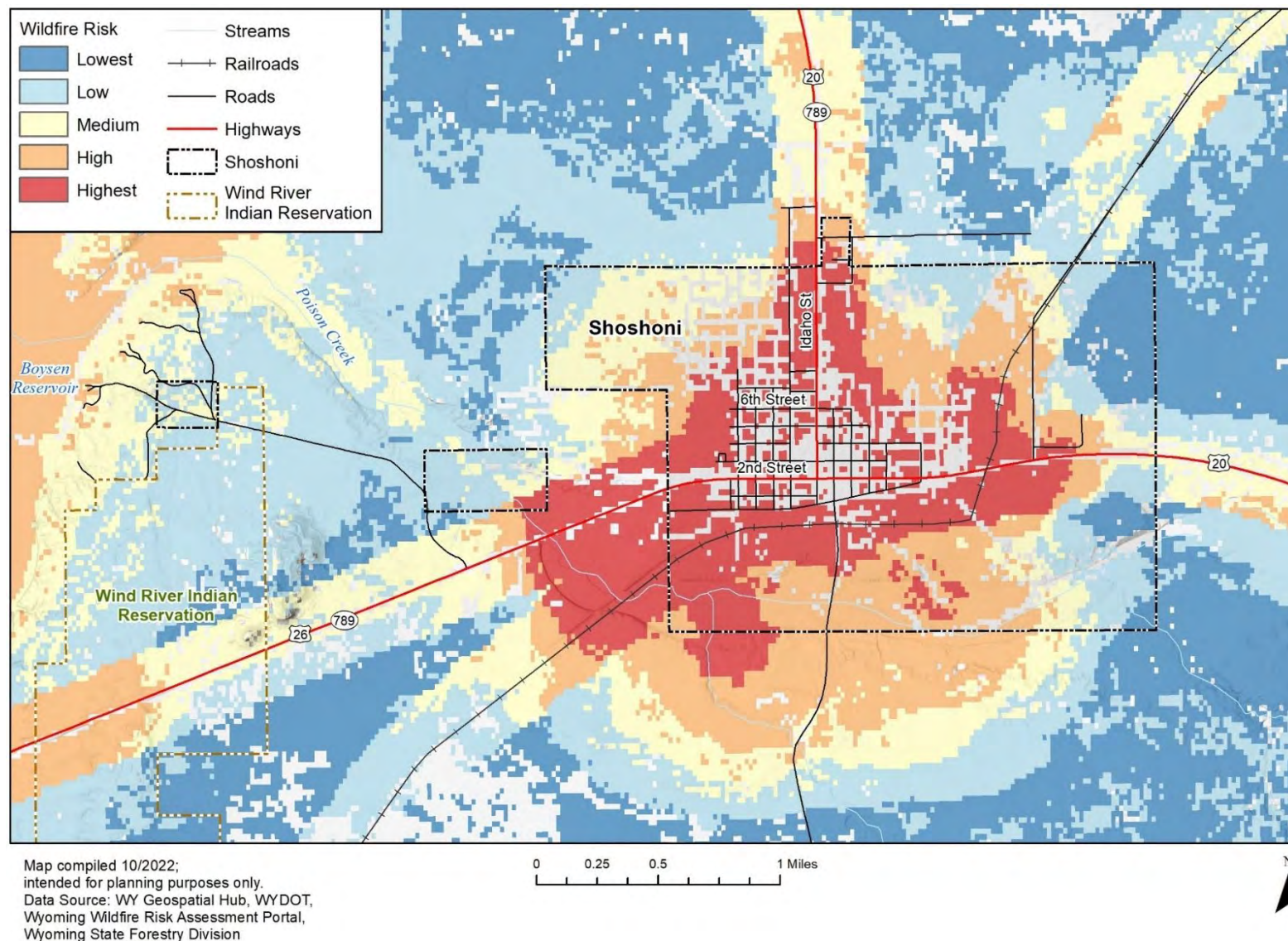


Figure 21 Shoshoni Wildfire Risk



7 Mitigation Capabilities Assessment

As part of the regional plan update the Region and participating jurisdictions developed a mitigation capability assessment. Capabilities are those plans, policies and procedures that are currently in place that contribute to reducing hazard losses. Combining the risk assessment with the mitigation capability assessment results in “net vulnerability” to disasters and more accurately focuses the goals, objectives, and proposed actions of this plan. The purpose of this effort was to identify policies and programs that were either in place or could be undertaken, if appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, projects, and programs to determine if they contribute to reducing hazard related losses.

Most communities, including Fremont County, have developed and implemented emergency preparedness plans for a variety of contingencies. Emergency preparedness plans are primarily reactive and focus on the community’s readiness to respond to natural and man-made disasters if and when they occur. Fremont County has implemented several emergency preparedness measures, such as stockpiling sandbags for future flood events, development of regional emergency response teams, and education and training for first responders. These measures can also be thought of as hazard mitigation measures because they are designed to limit the adverse effects of emergencies when they occur.

7.1.1 Regulatory Mitigation Capabilities

Table 23 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Fremont County and each participating jurisdiction. Excerpts from applicable policies, regulations, plans and programs descriptions follow to provide more detail on existing mitigation capabilities.

Details on NFIP participation and flood map status are provided in Table 24 below.

Table 23 Fremont County NFIP Participation by Jurisdiction

Community	Date of Entry into Program	Current Effective Map Date
Fremont County	07/08/75	02/05/14
Lander	09/01/78	09/16/11
Dubois	09/16/11	09/16/11
Riverton	09/01/99	09/16/11
Shoshoni	05/28/86	NSFHA*
Hudson	07/17/78	09/16/11
Pavillion	N/A	Not mapped

*No Special Flood Hazard Areas (SFHA) Currently Identified

Table 24 Summary of Fremont County Mitigation Capabilities

Planning & Regulatory Tools (ordinances, codes, plans)	County	Dubois	Hudson	Lander	Pavillion	Riverton	Shoshoni	Changes since 2017?
Comprehensive, Master, or General Plan	Yes Minimal Land Use Plan	No	No	Yes 2012 Master Plan	No	No	No	n/a
Capital Improvement Program or Plan (CIP)	no	no	no	no	n/a	n/a	n/a	n/a
Floodplain Management Plan	n/a	Yes	Yes	n/a	n/a	Yes	n/a	n/a
Stormwater Program / Plan / Ordinance	No	No	No	No	No	No	No	No
Community Wildfire Protection Plan (CWPP)	Yes Countywide Revised 2019	Yes Countywide Revised 2019	Yes Countywide Revised 2019	Yes Countywide Revised 2019	Yes Countywide Revised 2019	Yes Countywide Revised 2019	Yes Countywide Revised 2019	n/a
Erosion / Sediment Control Program	No	No	No	No	No	No	No	No
Economic Development Plan	No	No	No	No	No	No	No	No
Building Codes (Year)	Yes Commercial only	Yes	Yes	Yes	Yes	Yes IBC 2006	Yes	n/a
Site Plan Review Requirements	No	No	No	Yes	No	No	No	n/a
Zoning Ordinance (Land Use)	Yes Development in flood hazard areas	Yes Development in flood hazard areas	Yes Development in flood hazard areas	Yes	No	No	No	n/a
Subdivision Ordinance	Yes	No	No	No	No	No	No	Updated County Subdivision Regulations

Planning & Regulatory Tools (ordinances, codes, plans)	County	Dubois	Hudson	Lander	Pavillion	Riverton	Shoshoni	Changes since 2017?
								in 2017 and 2021
National Flood Insurance Program (NFIP) Participant	Yes Joined 7/8/75	Yes Joined 9/1/78	Yes Joined 7/17/78	Yes Joined 9/1/78	No	Yes Joined 9/1/99	Yes Joined 5/28/86	No
Flood Insurance Study / Flood Insurance Rate Map / DFIRM	Yes 2/5/2014	Yes 2/5/2014	Yes 2/5/2014	Yes 2/5/2014	No	Yes 2/5/2014	Yes 2/5/2014	No
Floodplain Ordinance	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Elevation Certificates for Floodplain Development	Yes	Yes	Yes	Yes	No	No	No	Required for any development within the mapped floodplain
Community Rating System (CRS) Participant	No	No	No	No	No	No	No	No
Open Space / Conservation Program	No	No	No	No	No	No	No	No
Growth Management Ordinance	No	No	No	No	No	No	No	No
Other Hazard Ordinance (steep slope, wildfire, snow loads, etc.)	No	No	No	No	No	No	No	No
Other	2016 Countywide EOP, 2016 Countywide THIRA, 2000 Flood Emergency Response Plan, South	No	No	No	No	No	No	No

Planning & Regulatory Tools (ordinances, codes, plans)	County	Dubois	Hudson	Lander	Pavillion	Riverton	Shoshoni	Changes since 2017?
	Pass City Historic Zoning (building appearance)							

7.1.2 Administrative and Technical Mitigation Capabilities

Administrative/Technical Resources	County	Dubois	Hudson	Lander	Pavillion	Riverton	Shoshoni	Changes since 2017?
Planning Board / Commission	Yes	No	No	Yes	No	No	No	No
Mitigation Planning Committee	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Maintenance Programs (tree trimming, clearing drainage, etc.)	No	No	No	No	No	No	No	No
Emergency Manager	Yes	No	No	No	No	No	No	No
Building Official	No	No	No	No	No	Yes	Yes	No
Floodplain Administrator	Yes	Yes	Yes	Yes	No	Yes	Yes	
Community Planner	Yes	No	No	No	No	No	No	No
Transportation Planner	No	No	No	No	No	No	No	No
Civil Engineer	No	No	No	No	No	No	No	No
GIS Capability	Yes	No	No	No	No	No	No	No
Warning Systems / Services (flood)	Yes	No	No	No	No	No	No	No
Warning Systems / Services (other / multi hazard)	No	No	No	No	No	No	No	No
Grant Writing / Management	No	No	No	No	No	No	No	No
Other:	County Drought Task Force, County HazMat Regional Response Team, Actively participated in MMMS	No	No	No	No	No	No	No

Administrative/Technical Resources	County	Dubois	Hudson	Lander	Pavillion	Riverton	Shoshoni	Changes since 2017?
	mapping effort							

7.1.3 Financial Capabilities

Table 25 identifies the County and Town financial tools or resources that the jurisdictions have access to or are eligible to use and could potentially be used to help fund mitigation activities. Lander is currently working with the U.S. Army Corps of Engineers on the design phase for a flood mitigation barrier. The design phase is expected to be completed by spring of 2023

Table 25 Fremont County and Jurisdictions Financial Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Has This Been Used for Mitigation in the Past?
Levy for Specific Purposes with Voter Approval	No	No
Utilities Fees	No	No
System Development / Impact Development Fee	No	No
General Obligation Bonds to Incur Debt	No	No
Special Tax Bonds to Incur Debt	No	No
Open Space / Conservation Fund	No	No
Stormwater Utility Fees	No	No
Capital Improvement Project Funding	No	No
Community Development Block Grants (CDBG)	No	No
Other	No	No

7.1.4 Education and Outreach Capabilities

Table 26 shows the mitigation education and outreach capabilities the County and jurisdictions have in place now. Additional information shared by the HMPC is listed after the table.

Table 26 Jurisdictions Mitigation Education and Outreach Capabilities

Education & Outreach	Yes/No (And Briefly Describe)
Public Education /Outreach Program	No
Local Citizen Groups That Communicate Hazard Risks	No
Firewise	No
StormReady	Yes

Education & Outreach	Yes/No (And Briefly Describe)
Other?	No

7.1.5 Opportunities for Enhancement

Based on the capabilities assessment, Fremont County and the municipalities have several existing mechanisms in place that already help to mitigate hazards. There are also opportunities for the jurisdictions to expand or improve on their policies, programs and fiscal capabilities and further protect the community. As an example, the County became StormReady designated by the National Weather Service in recent years. Future improvements may include providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and WOHS. Additional training opportunities will help to inform County and municipal staff members on how best to integrate hazard information and mitigation projects into their departments. Continuing to train staff on mitigation and the hazards that pose a risk to the County will lead to more informed staff members who can better communicate this information to the public.

Other opportunities include improved cross-jurisdictional communication on evacuation and awareness to mitigate life safety impacts during dam incidents, floods, or wildfires including the development of brochures and using existing communication capabilities through social media or other media. Other specific opportunities for improvement include:

- Update OEM's page on the county website to reflect links to Emergency Preparedness information specific to Fremont County, as well as the FEMA Emergency Preparedness website.

8 Mitigation Strategy

This section describes the mitigation strategy and mitigation action plan for Fremont County. See Chapter 5 of the base plan for more details on the process used to develop the mitigation strategy.

8.1 Mitigation Goals

Fremont County has identified goals to guide the development of the Hazard Mitigation Strategy. The potential hazards, risks and vulnerabilities were also considered in development of the goals. The goals and objectives of the Fremont County Local Hazard Mitigation Plan are to:

- Goal #1 Protect Life and Property from Hazard Impacts
 - Objective 1.1 Implement activities that assist in protecting lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to losses from natural and technological hazards.
 - Objective 1.2 Reduce losses and repetitive damages for chronic natural hazard events while promoting insurance coverage for catastrophic natural hazards.
 - Objective 1.3 Improve hazard assessment information to allow informed decisions on and encourage preventative measures for existing development in areas vulnerable to natural hazards.
- Goal #2 Increase Public Awareness of Hazards
 - Objective 2.1 Develop and implement education and outreach programs to increase public awareness of the risks associated with natural and technological hazards.

- Objective 2.2 Provide information on tools, partnership opportunities, and funding resources to assist in implementing mitigation activities.
- Objective 2.3 Improve and expand hazard notification capabilities (new).
- Goal #3 Protect Natural Systems from Hazard Impacts
 - Objective 3.1 Balance watershed planning and natural resource management by using a “multiple use” strategy on public lands and other land use planning tactics with the outcome of natural hazard mitigation to protect life, property, and the environment.
 - Objective 3.2 Preserve, rehabilitate, and enhance natural systems under a multiple use strategy on public lands to serve natural hazard mitigation functions.
- Goal #4 Strengthen Partnerships related to Hazard Mitigation
 - Objective 4.1 Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit organizations, business, and industry to gain a vested interest in implementation of the mitigation plan.
 - Objective 4.2 Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.
- Goal #5 Enhance Emergency Services and Reduce Impacts to Critical Infrastructure
 - Objective 5.1 Establish policy to ensure mitigation projects for critical facilities, services, and infrastructure.
 - Objective 5.2 Strengthen emergency operations by increasing collaboration and coordination among public agencies, non-profit organizations, business, and industry.
 - Objective 5.3 Coordinate and integrate natural and technological hazard mitigation activities, where appropriate, with emergency operations plans and procedures.

8.2 Mitigation Actions

This section provides updates on the actions identified in the 2017 Fremont County Multi- Hazard Mitigation Plan and new actions identified during the 2022 Regional Plan development.

8.2.1 Progress on 2017 Actions

During the 2022 planning process the Fremont County Planning Team reviewed all the mitigation actions from the 2017 plan. Of their 34 mitigation actions from 2017, 29 of the county actions are continuing or are implemented annually, demonstrating ongoing progress and building the community's resiliency to disasters. Four (4) actions for municipalities that did not participate in the 2022 plan update are considered “continuing” should they decided to participate in future updates; these are detailed in Table 27. The following lists a deleted mitigation action.

Table 27 Completed and Deleted Mitigation Actions

2017 ID	Mitigation Action	Hazards Mitigated	Jurisdiction	Priority	Status/ Implementation Notes
Earthquake – 1	Secure items that may cause injuries from above through public education for households and through acquisition and installation of stabilizing braces and window	Earthquake	Fremont County	Low	Deleted due to cost effectiveness

2017 ID	Mitigation Action	Hazards Mitigated	Jurisdiction	Priority	Status/ Implementation Notes
	films for schools and critical facilities				concerns and low priority.

8.2.2 Identification and Implementation of Mitigation Measures

Fremont County has identified several potential hazard mitigation projects that would benefit the County and reduce potential risks and vulnerabilities. The proposed mitigation projects below listed in Table 28 have been discussed with the multi-jurisdictional HMPC. During the 2022 Regional Plan development of existing mitigation projects for Fremont County were assessed and determined whether the action was completed, ongoing/continued, or deleted. Reasons that some actions have not been completed include low priority, lack of funding, or lack of administrative resources. The HMPC's evaluation of action items and updated goals also lead to the addition of new strategies. The action plans were also shared amongst the regional plan participants to showcase progress and stimulate ideas amongst the respective planning committees in each county. Table 29 lists the hazard, the project, the priority, who the responsible agency is, the goal the project supports, and a possible funding source. The tables are separated into ongoing mitigation strategies from 2017, new mitigation strategies identified in 2022, and completed and deleted strategies from 2017. Mitigation actions for municipalities that did not participate in the 2022 plan update are considered "continuing" should they decided to participate in future updates.

Table 28 Fremont County Mitigation Action Plan

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
F-1	Goals: 3, 5 Lifelines: FWS	Upstream storage for shortage of water for irrigation and flood mitigation.	Drought	Fremont County	Fremont County Commissioners, Wyoming Water Development Commission; Tribes	2050	\$300,000,000 Wyoming Water Development Commission	Medium	Continue – In Progress. With drought conditions for 2022 listed as "abnormally dry", this issue remains a viable project but funding continues to plague progress on it.
F-2	Goals: 2, 3 Lifelines: FWS	Develop water conservation program/education.	Drought	Fremont County	Fremont County Extension Service, local jurisdictions including Hudson and Lander	Annual Implementation	\$5,000 State of Wyoming	Medium	Continue – In Progress.
F-3	Goals: 3, 5 Lifelines: FWS	Develop groundwater supplies as an additional water resource during times of drought.	Drought	Fremont County	Fremont County Commissioners, Wyoming Water Development Commission, Towns of Hudson, Lander, and Shoshoni	2025	\$3,000,000 Water Development Commission	Medium	Continue – Not Started. With drought conditions for 2022 listed as "abnormally dry", this issue remains a viable project but funding continues to plague progress on it.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
F-4	Goals: 1, 2 Lifelines: NA	Public education on safety measures to take during an earthquake.	Earthquake	Fremont County	Fremont County Government, Fremont County EM	Annual Implementation	\$2,000 Fremont County EM	Low	Continue – In Progress. OEM website is in the process of updating and adding links for public education. Current links will lead to FEMA; NOAA/weather; Wyoming Road & Travel; Wildland Urban Interface that will provide information.
F-5	Goals: 1, 5 Lifelines: Trans	Culverts and Drainage Maintenance Project to mitigate damage to county road infrastructure	Flood	Fremont County	County wide Road & Bridge, Planning	Annual Implementation	No estimated cost Fremont County Transportation Dept., FHWA, WYDOT	High	Continue – In Progress. FCR&B is in the process of updating failed culverts. The price has doubled or tripled currently for culverts. We are also in the process of mapping/inventorying culverts.
F-6	Goals: 5 Lifelines: NA	Map historic flood plains outside FEMA FIRM areas and update county planning to limit development within designated areas	Flood	Fremont County	County Planning	2023-2028	\$250,000. WOHS, County funds	Low	Continue – In Progress. This project has not moved forward as there is no real data available to support regulation outside FEMA mapped areas.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
F-7	Goals: 1, 3, 5 Lifelines: NA	Popo Agie River flood prevention and stabilization	Flood	Fremont County	Lander City Government, Popo Agie Conservation District, NRCS	2022-2028	\$3,000,000 + Popo Agie Conservation District	High	Continue – In Progress. City of Lander is working with USACE on possible flood wall
F-8	Goals: 1 Lifelines: NA	Continued compliance with participation in NFIP	Flood	Fremont County	Fremont County Planning Commission, Towns of Hudson, Riverton, Lander, and Dubois	Annual Implementation	\$5,000 WOHS	High	Continue – In Progress. Fremont County Planning continues to address any and all construction within the mapped FIRMs. Fremont County Planning assists local communities in addressing concerns regarding implementation of the NFIP in their jurisdictions.
F-9	Goals: 1, 5 Lifelines: Trans	Little Warm Springs Road Culvert Replacement	Flood	Fremont County	Town of Dubois Fremont County	2024	\$30,000	Medium	Continue – Not Started. This road is within Town limits. Fremont County has an easement with the right to maintain the road. Culverts may become silted in, and with high water may flood the road. Place overflow culvert? Coordination is needed with Fremont

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
									County Road Dept. This project should be engineered to mitigate harm to Dubois residents. Town of Dubois does not own the property and does not have an easement.
F-10	Goals: 1, 5 Lifelines: NA	Taylor Creek Drainage Enhancements and stream stabilization (West View Park Subdivision)	Flood	Fremont County	Town of Dubois	2024	\$50,000	High	Continue – Not Started. WYDOT engineers have been contacted to ascertain the degree that the State may be involved. The Town requests to know how to proceed. Requesting an application form to commence this project.
F-11	Goals: 1, 5 Lifelines: NA	North Heights Subdivision Drainage Enhancements	Flood	Fremont County	Town of Dubois	2024	\$90,000	Low	Continue – In Progress. In 2018 thirty-six culverts (\$7,490) were purchased. Some have been installed in locations throughout the North Heights Subdivision to enhance the drainage. The project is

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
									expected to be completed by the end of 2023. Reimbursement has not yet been requested.
F-12	Goals: 1, 3, 4, 5 Lifelines: NA	Implement permanent flood mitigation projects along the Middle Fork of the Popo Agie recommended by Army Corp of Engineers in 2017	Flood	Fremont County	Fremont County Road & Bridge, City of Lander,, Town of Hudson	By 2025	Varies by project, ACOE, FEMA, local funds	High	Continue – In Progress. Homeowners at the Popo Agie Estates mitigated per FEMA. Fremont County R&B did not assist with this mitigation.
F-13	Goals: 1, 2 Lifelines: NA	Further identify and continue monitoring landslides in critical areas	Landslide	Fremont County	Fremont County Planning Commission, Wyoming State Geological Survey, WYDOT Hudson, Lander,	Annual Implementation, particularly during wet cycles	\$500,000 Wyoming State Geological Survey, Wyoming Department of Transportation	Medium	Continue – In Progress. Town of Hudson has identified their water tower/main water supply would be at risk if a landslide happened near it. Landslides are addressed as they become evident that one is occurring in an area that is populated, or infrastructure is threatened.
F-14	Goals: 1, 2 Lifelines: NA	Stabilize landslides that threaten the population	Landslide	Fremont County	Fremont County Government,	Annual Implementation	\$1,000,000 + Fremont County EM	Medium	Continue – In Progress. Landslides are addressed as they

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		or infrastructure of the County			Wyoming Department of Transportation, University of Wyoming				become evident that one is occurring in an area that is populated, or infrastructure is threatened.
F-15	Goals: 1, 5 Lifelines: NA	Refine identification of critical facilities in each community and further assess hazard vulnerability	All Hazards	Fremont County	County EM Towns of Hudson, Riverton, Dubois, Lander, Pavillion, Shoshoni	Annual Implementation	Funding through department budget	Low	Continue – In Progress. As part of HMP update. Continued maintenance and additional assessment on facilities identified in updated risk assessment
F-16	Goals: 1 Lifelines: ENG, FWS, HM	Identify the need for generator receiver points for assisted living and nursing homes and encourage installation where applicable	All Hazards	Fremont County	County EM Public health	Annual Implementation	Unknown at this time. Prices keep changing drastically due to inflation	Medium	Continue – Not Started. County EM will work with Public Health to complete this project
F-17	Goals: 1 Lifelines: FWS, HM	Improve planning for sheltering and evacuation of hospital and nursing homes in Wyoming Life Resource Center	All Hazards	Fremont County	Wyoming Life Resource Center, City of Lander, County EM	2025	Wyoming Life Resource Center	Medium	Continue – In Progress. Changes to agencies/personnel involved, this project will become a re-start (Wy. Life Resource has had many changes, especially in facility/ building availability.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
F-18	Goals: 1, 2, 5 Lifelines: Comm	Improved notification system and the ability to expand and adapt with new technologies	All Hazards	Fremont County	County EM and Dispatch	Annual Implementation	Funding through department budget	High	Continue – In Progress. ARPA funds have been requested to upgrade towers, replace WYOLINK radios which will improve communications in Fremont County.
F-19	Goals: 1, 2, 4, 5 Lifelines: Comm	Upgrade the radio system for school district to enable better communication with 1st responders	All Hazards	Fremont County	County EM and Dispatch School District	Annual Implementation	Varies by needs of each system	Low	Continue – Not Started. Law Enforcement, Fire and EMS first responders are now moved ahead for slated interoperable radio replacement. Radio towers are also nearing end-of-life. Infrastructure for communications at responder level will take precedence.
F-20	Goals: 5 Lifelines: ENG	Improved generator backup power capabilities for critical facilities	All Hazards	Fremont County	County EM School District	Annual Implementation	Funding would have to come through each school district. Unknown amount.	Medium	Continue – In Progress. Funding is always limited; COVID-19 has contributed heavily to prioritizing how what funding is available is spent.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
F-21	Goals: 5 Lifelines: ENG	Identify and acquire generators and/or hook ups for school districts buildings to increase public shelter areas	All Hazards	Fremont County	County EM School District	Annual Implementation	Funding would have to come through each school district. Unknown amount.	Medium	Continue – In Progress. County will follow up with school districts
F-22	Goals: 1, 2, 4, 5 Lifelines: SS, HM, FWS	Develop and incorporate into the plan a list of hazard exposure factors for consideration when locating and planning construction of public structures, including critical facilities	All Hazards	Fremont County	Fremont County Planning Commission, Fremont County Government, Towns of Hudson, Lander, Riverton and Shoshoni	Annual Implementation	\$40,000 WOHS, FEMA, County and local jurisdictions staff time for administration of floodplain ordinances for the County, Hudson, Lander, Riverton and Shoshoni	High	Continue – In Progress. Fremont County Planning reviews and administers the County Subdivision Permitting process as well as the Floodplain Zoning Regulation for those areas outside the City Limits. State Statute requires the local Conservation Service provide a letter and recommendation to the Planning Commission regarding soils in any proposed Subdivision. Those recommendations are included in the Staff Report of the Subdivision and a copy of the Soils

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
									Report is included in the Subdivision Permit. This does not include mine subsidence or avalanches. No construction is allowed in a mapped floodway unless an H&H study has been conducted to ensure no change to Base Flood Elevation is caused by the construction, this includes Public or critical structures, and any development in the floodplain requires a elevation certificate in compliance with the Floodplain Zoning Regulations.
F-23	Goals: 1, 2 Lifelines: NA	Public education about local hazards including Avalanche, Dam Failure, Drought, Earthquake, Expansive Soils, Extreme Cold, Flood, Hail, Hazardous Materials, High Winds, Landslide, Lightning,	All Hazards	Fremont County	Fremont County Emergency Management (EM), Towns of Hudson, Lander, Riverton,	Annual Implementation	\$2,500 Fremont County EM	Medium	Continue – In Progress. OEM website is in the process of updating and adding links for public education. Current links will lead to FEMA; NOAA/weather;

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		Mine Subsidence, Severe Winter Weather, Tornado, Wildland Fire			Pavillion and Shoshoni				Wyoming Road & Travel; Wildland Urban Interface that will provide information.
F-24	Goals: 1, 2 Lifelines: NA	Public education about local building, fire codes, earthquake, and flood proofing standards	All Hazards	Fremont County	Fremont County EM, Towns of Hudson, Lander, Riverton and Shoshoni	Annual Implementation	\$2,500 Fremont County Planning	Medium	Continue – In Progress.
F-25	Goals: 1, 2 Lifelines: Comm	Encourage the purchase of Weather Radios for notification of hazardous conditions including Drought, Extreme Cold, Flood, Hail, Hazardous Materials, High Winds, Lightning, Severe Winter Weather, Tornado, Wildland Fire	Severe Weather	Fremont County	Fremont County EM, Individuals in the population	Annual Implementation	\$1,000 Fremont County EM	High	Continue – In Progress. OEM website is in the process of updating and adding links for public education. Current links will lead to FEMA; NOAA/weather; Wyoming Road & Travel; Wildland Urban Interface that will provide information.
F-26	Goals: 1, 2 Lifelines: NA	Educate public on severe weather hazards including the needs for personal safety and self-sufficiency for at least 72 hours	Severe Weather	Fremont County	Town of Shoshoni Administration, in partnership with Fremont County EM	Annual Implementation	\$1,000	Medium	Continue – In Progress. Will always be ongoing public education. OEM website is in the process of updating and adding links for

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
									public education. Current links will lead to FEMA; NOAA/weather; Wyoming Road & Travel; Wildland Urban Interface that will provide information.
F-27	Goals: 1, 2 Lifelines: NA	Encourage purchase of 72-Hour Kits and educate public on need for kits	Severe Weather	Fremont County	Fremont County EM	Annual Implementation	\$1,000 Fremont County EM	High	Continue – In Progress. OEM website is in the process of updating and adding links for public education. Current links will lead to FEMA; NOAA/weather; Wyoming Road & Travel; Wildland Urban Interface that will provide information.
F-28	Goals: 1, 4 Lifelines: NA	Improve fuel hazard assessments in identified communities at risk countywide.	Wildfire	Fremont County	Local Fire Departments Firewise WY State Forestry	Annual Implementation	\$100,000	High	Continue – In Progress. Western Wildland Urban Interface Grant Program is the primary funding source used to provide wildland fire hazard mitigation for residents of Fremont

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
									County. It is a cost-share program available to homeowners for fuel mitigation and forest health activities.
F-29	Goals: 1, 2, 4 Lifelines: NA	Educate public on wildland fire/urban interface and encourage reduction of fuels loads.	Wildfire	Fremont County	Fremont County EM, all Fire Districts, FIREWISE	Annual Implementation	Funded through grants annually United States Forest Service, Bureau of Land Management, Bureau of Indian Affairs	High	Continue – In Progress. Western Wildland Urban Interface Grant Program is the primary funding source used to provide wildland fire hazard mitigation for residents of Fremont County. It is a cost-share program available to homeowners for fuel mitigation and forest health activities.
F-30	1, 5 Safety & Security, Food, Water, Shelter, Health & Medical, Energy, Transportation	Union Pass Landslide mitigation. Union Pass is located on the Wind River Range of Fremont County. It is a heavily populated area with numerous subdivisions. There is one road leading into/out of the Union Pass communities, and this	Landslide/ Rockfall/ Debris Flow	Fremont County	Fremont County Transportation Department, Fremont County EMA	2024-2026	\$1,500,000; Capital Improvement Plan	Medium	New in 2022

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		road is along a documented landslide area. In order to ensure first responder access, evacuation routes for residents, and secure long-term safety and access, the landslide area requires rebuilding and mitigation to reduce the potential for damage to the access road.							

Table 29 Town of Pavillion Mitigation Actions

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
P-1	Goals: 1, 4, 5 Lifelines: NA	Replace current water meters with new energy efficient system with remote read to reduce water system loss and enhance drought resilience	Drought	Town of Pavillion	Town of Pavillion, EPA, SLIB, Safe Water Revolving Funds	To be determined	\$215,000	Low	Continue – Not Started.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
P-2	Goals: 2 Lifelines: Comm	Update/install a warning system	All Hazards	Town of Pavillion	Town of Pavillion	To be determined	\$75,000	Low	Continue – Not Started.
P-3	Goals: 1, 2 Lifelines: Comms, SS	Review and implement appropriate regulations with regards to mitigation of new development in WUI communities such as roads with adequate emergency ingress/egress and ignition resistant building construction	Wildfire	Town of Pavillion	County Planning	2025	Low cost; staff time and existing resources	Low	Continue – Not Started.
P-4	Goals: 1, 2, 3, 5 Lifelines: SS	Annual fuels treatment to create a fire break around Pavillion	Wildfire	Town of Pavillion	Town of Pavillion	Annual Implementation	\$5,000	Low	Continue – Not Started.

9 Implementation

Moving forward the County will use the mitigation action table in the previous section to track progress on implementation of each project. Some progress has been made since the plan was originally developed in 2007-8 and will continue to be tracked over time. Implementation of the plan overall is discussed in Chapter 6 in the Regional Plan.

The Fremont County HMPC formed during the 2022 Regional Plan development will be responsible for implementing and reviewing the plan action items. The HMPC will meet no less than semi-annually, or as time permits.

The Fremont County Commissioners and the Mayor of all cities and towns (except where noted in Section 1) in Fremont County will adopt the Region 5 Hazard Mitigation Plan and each jurisdiction will take responsibility for plan implementation of mitigation issues arising in their jurisdictions. Plan implementation and evaluation will be a shared responsibility among the HMPC. The Fremont County EM Coordinator will serve as a convener to facilitate the HMPC meetings and will assign tasks such as updating and presenting the Plan to the members of the group.

9.1 Incorporation into Existing Planning Mechanisms

Also, discussed in Chapter 6 is the importance of implementation and incorporation of the principles of this plan into other planning mechanisms.

During the 2022 planning process the HMPC discussed the importance of coordinating the mitigation plan with other planning processes, and vice versa. The group noted that the CWPP and County EOP acknowledges the HMP. The THIRA also sources the hazards information in the HMP.

As described in the capability assessment, the County and municipalities already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- County or community comprehensive or land use plans
- County or community development codes
- County or community Emergency Operations Plans
- THIRA
- CWPP
- Capital improvement plans and budgets including County Road/Bridge projects
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands
- Firewise planning
- Master planning efforts
- River corridor and greenway planning efforts in Lander
- WYDOT rockfall and landslide mitigation efforts
- Office of State Lands and Investments Drinking Water or Clean Water Intended Use Plan
- Other plans, regulations, and practices with a mitigation aspect

9.2 Funding Sources

Funding for the proposed mitigation projects may come from a variety of sources. Below is a list of funding possibilities. This list is not tied directly to each proposed project; however, these programs could work for specific projects or multiple projects.

Local Government

- General revenues in the form of matches.
- County and Municipal Utility Authorities.

State of Wyoming

- Community Development Block Grant Program.
- Federal Mineral Royalty Capital Construction Account.
- Office of State Lands and Investments grants and loans
- Wyoming Water Development Program.
- State and Community Highway Safety, Department of Transportation.
- Transportation Enhancement Activities Local (TEAL).
- Wildfire Mitigation Grant (State Forestry Division).

Federal Government Agency Programs

- FEMA Hazard Mitigation Assistance Grants including:
 - Building Resilient Infrastructure and Communities (BRIC)
 - Pre-Disaster Mitigation (PDM).
 - Flood Mitigation Assistance Program (FMA).
 - Hazard Mitigation Grant Program (HMGP).
 - Notice of funding availability typically released in June with applications due in October/November of each year.
 - HMGP is dependent on federally declared disasters within the State and funding amount is based on a percentage of disaster relief costs.
- USDA Environmental Quality Incentive Program.
- USDA Conservation Reserve and Conservation Reserve Enhancement Program.
- USDA Small Watersheds (NRCS).

There are many more potential funding opportunities available to the municipalities and county. Funding research will be done during the scoping process for each project. New funding mechanisms may be present that were not before.

9.3 Monitoring, Evaluating and Updating the Plan

Fremont County will follow the procedures to review and update this plan in accordance with Region 5 as outlined in Chapter 6 of the Regional Plan. The County and municipalities realize that it is important to review and update this plan regularly and update it on a five-year cycle. The Fremont County Annex to the Region 5 Plan will be evaluated on a regular basis to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities.

Sublette County Annex

Wyoming Region 5
Hazard Mitigation Plan
2023-2028

1 Mitigation Planning and Sublette County Planning Team

This County Annex builds upon previous versions of the Sublette County Multi-Hazard Mitigation Plan that were incorporated into the regional hazard mitigation plan completed in 2017. This County Annex builds upon the previous version of the Sublette County Hazard Mitigation Plan completed and approved by the Federal Emergency Management Agency (FEMA) in 2017. The Local Emergency Planning Committee (LEPC) held responsibility for implementation and maintenance of the plan. The Sublette County Office of Homeland Security Coordinator is responsible for updating the plan. The following jurisdictions were provided the opportunity to participate in the planning process during the update in 2022:

- Sublette County
- Town of Big Piney
- Town of Marbleton
- Town of Pinedale
- Hoback Ranches Special Improvement District

Hoback Ranches Special Improvement District joined the plan as a formal adopting jurisdiction during the update process. The Town of Big Piney declined to participate as adopting jurisdictions in the 2022 Regional Plan update process. Details and mitigation actions related to this town have been carried forward from the 2017 Regional Plan, should participation be desired in future update cycles. More details on the planning process followed and how the counties, municipalities, special district and stakeholders participated can be referenced in Chapter 3 of the base plan.

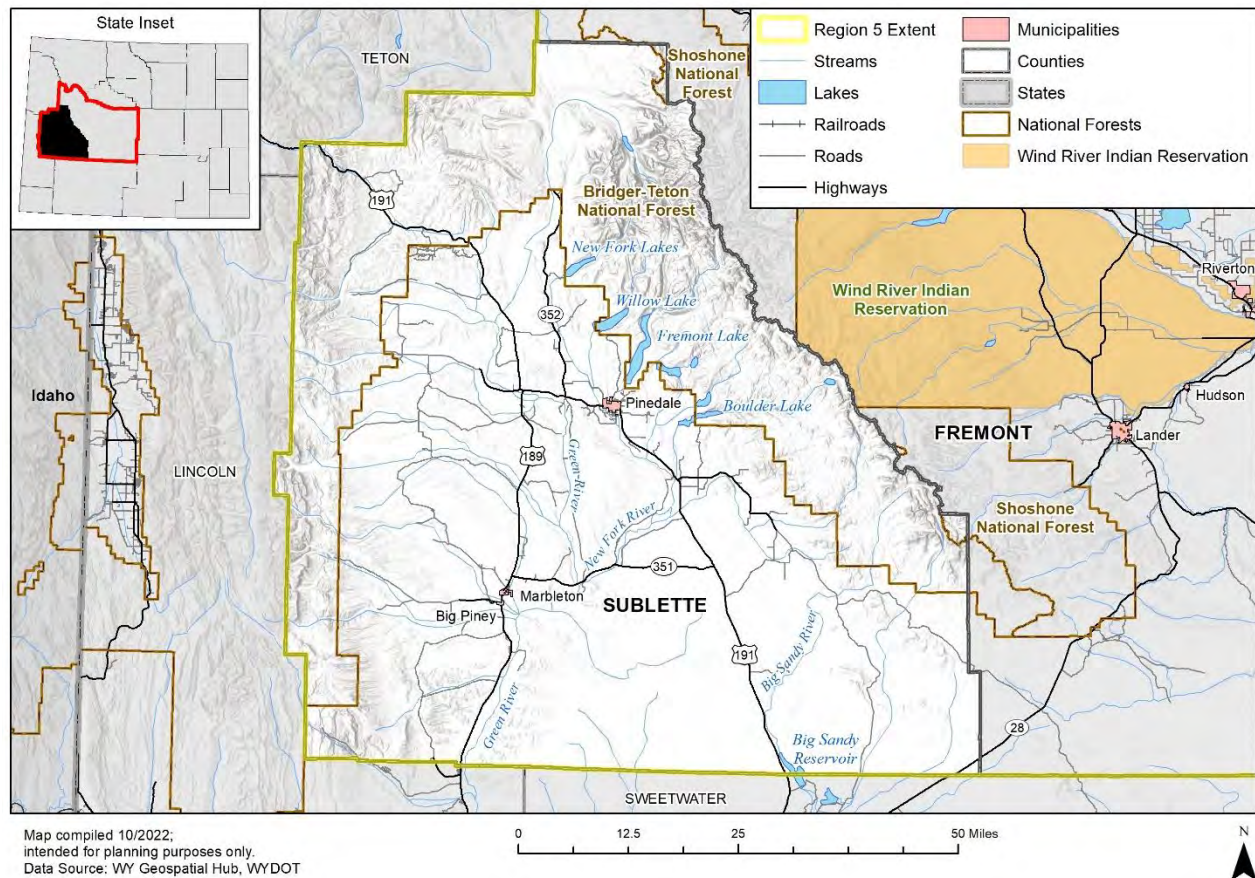
2 Geography and Climate

Sublette County encompasses approximately 4,936 square miles, most of which is 7,000 feet above sea level or higher and is located in northwestern Wyoming. Of the 23 counties in the State, Sublette County ranks sixth in land coverage. The County shares its borders with Teton, Fremont, Sweetwater, and Lincoln Counties. Within its boundaries lie the incorporated towns of Pinedale (largest town and County seat), Big Piney, and Marbleton.

The central portion of the County is a valley comprised of a sagebrush steppe eco-region. The topography ranges from valleys (6,280 ft.) to the pine covered mountains and high peaks of the Wind River Range (13,800 ft.) in the east and Wyoming Range to the west, and the Gros Ventre Range in the northwest. The Green River flows south through the County from its headwaters in the Wind River Range, and the County is home to over 1,300 lakes. Farming, ranching, the oil and gas industry, and tourism are the main financial stay of the County and define the land uses throughout the County.

The climate of Sublette County is classified as humid continental under the Koppen climate classification. Summers are usually warm, with very cold, dry winters. According to the Western Regional Climate Center (WRCC) Pinedale weather station, there is 11.34 inches of average annual precipitation and 68.5 inches of average annual snowfall. The average summer high temperature is 75.6°F and the average winter low temperature is 1°F, but the County has seen a record high of 94°F and a record low of -49°F.

Figure 1 Sublette County Base Map



3 Population Trends

As of the 2020 United States Census, there were a total of 8,728 people living in Sublette County. The population has been steadily decreasing based on estimates, and in 2021 the population was estimated to be 8,697.

Table 1 Population Estimates for Communities 2015-2020

	2010 Census	2015 Estimate	2016 Estimate	2017 Estimate	2018 Estimate	2019 Estimate	2020 Census
County Total	10,247	10,064	9,997	9,778	9,827	9,867	8,728
Town of Big Piney	552	530	563	614	572	527	363
Town of Marbleton	1,094	1,385	1,357	1,396	1,165	1,404	1,296
Town of Pinedale	1,878	1,865	2,044	2,003	2,263	1,962	1,867

Select Census demographic and social characteristics for Sublette County are shown in the table below. The table indicates the proportion of the population that may have special needs, such as the elderly or children under 5 years of age.

Table 2 Sublette County Demographic Profile

Sublette County	
Population	
Population Estimates, July 1, 2021	8,697
Population, Percent Change- April 1, 2020 (Estimates Base) to July 1, 2021	-0.4%
Population, Census, April 1, 2020	8,728
Persons Under 5 Years, Percent, 2020	4.3%
Persons Under 18 Years, Percent, 2020	21.1%
Persons 65 Years and Over, Percent, 2020	22.1%
Female Persons, Percent, 2020	46.1%
White Alone, Percent, 2020	94.6%
Black or African American Alone, Percent	1.0%
American Indian and Alaska Native Alone, Percent	1.4%
Asian Alone, Percent	0.8%
Native Hawaiian and Other Pacific Islander Alone, Percent	0.1%
Two or More Races, Percent	2.0%
Hispanic or Latino, Percent	7.3%
White Alone, Not Hispanic or Latino, Percent	88.3%
High School Graduate or Higher, Percent of Persons Age 25 Years+	95.4%
Bachelor's Degree or Higher, Percent of Persons Age 25 Years+	28.7%

Source: U.S. Census Bureau www.census.gov/

*Hispanic or Latino is considered to be an ethnicity and not a race. People who identify themselves as Hispanic or Latino can belong to one or more races. Therefore, the total percentage can be greater than 100%.

4 Development Trends

The largest incoming populations are those looking for a retirement or vacation home in the mountains where they can enjoy the outdoors. Development across the County is not uniform, and it is organized in some areas and random in others. The Town of Marbleton has seen an increase in population within the last decade, while the Town of Pinedale has not seen a significant population change, and the Town of Big Piney has seen a decrease in population. Overall, the population of the County is decreasing.

During the 2022 Regional Plan development, the Hazard Mitigation Planning Committee (HMPC) discussed growth and development trends in the County. According to the HMPC, Sublette County is experiencing substantial growth in single family dwellings in all portions of the County. To date there is not a comprehensive map of these new buildings. It is suspected that this could increase potential risk to wildfires and possibly floods. The oil and gas industry downturn has resulted in several abandoned sites that will become maintenance issues. New developments in corporate acquisitions show an increase of activity with increased rig counts, manpower, and ancillary companies hiring and ramping up. Most of the lands on which there is oil and gas exploration, development, and production are managed by the Bureau of Land Management. The County is not involved in review of these actions. Aging infrastructure in small towns is a concern. There has been some growth in the wildland urban interface areas. Some development pressures in or near flood hazard areas were noted, as there has been an increase in the number of parcels in flood areas in the County since the last plan.

5 Economy

The main economic activities in the County include oil and natural gas development; agricultural operations; and tourism, including hunting, fishing, hiking, camping, and winter sports activities. Oil and natural gas development and related activities account for most of the assessed valuation for property taxation in Sublette County. Oil and gas development is concentrated in multiple fields from Pinedale to Farson and La Barge. Most of these wells are located between the Deadline Ridge and Cretaceous Mountain, southwest of Big Piney. As of August 2022, there were 12,400 wells on file in Sublette County, 3,407 of these are producing wells. Production wells, pipelines, and compression and treatment facilities are located throughout the fields. Natural gas containing toxic hydrogen sulfide (sour gas) is produced, transported, and treated in the southwestern areas of the County.

Over a quarter of the total employed workforce in Sublette County works in the agriculture, forestry, fishing, hunting, and mining industry. The USDS 2017 Census of Agriculture reported that Sublette County ranks 12th in the State for overall sales of crops, livestock, poultry, and products. Crops account for 13% of total sales and livestock, poultry, and products account for 87%. As of 2017, there were 402 farms in Sublette County, totaling 546,353 acres of farmland.

Table 3 Sublette County Economic Profile

Characteristic	Sublette County
In Civilian Labor Force, Total, Percent of Population Age 16 Years+, 2016-2020	65.3%
In Civilian Labor Force, Female, Percent of Population Age 16 Years+, 2016-2020	61.8%
Total Accommodation and Food Services Sales, 2017 (\$1,000) (c)	24,657
Total Health Care and Social Assistance Receipts/Revenue, 2017	12,479
Total Merchant Wholesaler Sales, 2017 (\$1,000) (c)	62,328
Total Retail Sales, 2017 (\$1,000) (c)	100,334
Median Household Income (in 2020 dollars), 2016-2020	\$78,655
Per Capita Income in Past 12 Months (in 2020 Dollars), 2016-2020	\$49,313
Persons in Poverty, Percent	6.2%
Total Employer Establishments, 2020	417
Total Employment 2020	2,603
Total Annual Payroll, 2020	150,277
Total Employment, Percent Change 2019-2020	-7.5%
Total Non-employer Establishments, 2019	1,113

Source: U.S. Census Bureau www.census.gov/

6 Hazard Identification and Risk Assessment

6.1 Identified Hazards

The HMPC reviewed the hazards from the 2017 Sublette County Hazard Mitigation Plan for inclusion in the 2022 Regional hazard mitigation plan. The hazards list was compared with the hazards list found in the State of Wyoming's hazard mitigation plan, updated in 2020. Upon further review, the HMPC added expansive soils, mine subsidence, tornado, and wind hazards to be more consistent with the State's plan. The following table notes the summary of significance for each jurisdiction in the County based on a combination of geographic extent, potential magnitude/severity and probability as defined below.

Table 4 Overall Hazard Significance* Summary Table

Hazard	County	Big Piney	Marbleton	Pinedale
Avalanche	High	Low	Low	Low
Dam Failure	Low	Medium	Low	Low
Drought	High	High	High	High
Earthquake	Medium	Medium	Medium	Medium
Expansive Soils	Low	Low	Low	Low
Extreme Cold	Low	Low	Low	Low
Flood	Medium	High	High	High
Hail	Low	Low	Low	Low
High Winds	Medium	Medium	Medium	Medium
Hazardous Materials	Medium	Medium	Medium	Medium
Landslide	Medium	Low	Low	Low
Lightning	High	Medium	Medium	High
Mine Subsidence	Low	Low	Low	Low
Tornado	Low	Low	Low	Low
Wildfire	High	Medium	Medium	High
Winter Storm	High	High	High	High

*Significance based on a combination of Geographic Extent, Potential Magnitude/Severity and Probability as defined below.

Geographic Extent

Negligible: Less than 10 percent of planning area or isolated single-point occurrences

Limited: 10 to 25 percent of the planning area or limited single-point occurrences

Significant: 25 to 75 percent of planning area or frequent single-point occurrences

Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity

Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.

Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.

Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time, or result in many permanent disabilities and a few deaths.

Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time or many deaths occur.

Probability of Future Occurrences

Unlikely: Less than 1 percent probability of occurrence in the next year, or has a recurrence interval of greater than every 100 years.

Occasional: Between a 1 and 10 percent probability of occurrence in the next year, or has a recurrence interval of 11 to 100 years.

Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years

Highly Likely: Between 90 and 100 percent probability of occurrence in the next year, or has a recurrence interval of less than 1 year.

Overall Significance

Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.

Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.

High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

6.1.1 Hazards Considered but Not Profiled

This plan does not further evaluate the following hazards:

- Acts of Terrorism
- Animal and wildlife diseases
- Civil Disturbances
- Pandemic
- Power Outages
- Air Transportation Accident
- Health-Related Emergencies
- Liquefaction
- Volcanism and Yellowstone Volcanic Explosion

It is important to be aware of the probability of these events and the associated impacts for Sublette County, however, the hazard identification described in Chapter 4 omits these hazards due to the limited relevance in the regional context of this plan or being addressed in other planning mechanisms. Some of the above listed hazards are acknowledged in other hazard profiles. For example, power outage is not identified as an individual hazard because it is generally a consequence associated with other greater hazard events, and liquefaction is addressed in the earthquake section. Additionally, volcanism and a Yellowstone volcanic explosion has been excluded due to the low probability of occurrence combined with the very minimal opportunities/resources to mitigate. It was noted by the HMPC in 2017 that animal and wildlife diseases including chronic wasting can have a major economic impact if livestock and ungulate populations are affected. Pandemic was considered due to the ongoing Covid-19 Pandemic but was determined that hazard is covered under existing public health plans.

6.2 Building Inventory and Assets

In addition to people, structures, critical facilities and infrastructure, and other important assets in Sublette County are potentially exposed to hazards identified in this plan. Table 5 summarizes the property inventory for the County and each participating jurisdiction, based on improvement value (i.e., structures) and includes the building count and value grouped by parcel type and jurisdiction. This is an assessment of the overall property exposed within the County and by jurisdiction.

Assets inventoried to determine vulnerability include people, structures, critical facilities, and natural, historic, or cultural resources. For the regional planning process, locally available GIS databases were utilized. Parcel and assessor data was obtained through their respective websites which include an on-line map and data for download. This information provided the basis for building exposure and property types. The focus of the analysis was on "improved" or developed parcels. These parcels were identified based on an improvement value greater than zero. Abstract Codes were used to identify occupancy type as shown in the following table, which includes summations of total improved value for the various property types.

Table 5 Sublette County Building Inventory and Value by Jurisdiction

Jurisdiction	Improved Parcels	Improved Value	Est. Content Value	Total Exposure
Big Piney	256	\$27,341,218	\$16,278,791	\$43,620,009
Marbleton	485	\$60,237,177	\$35,238,064	\$95,475,241
Pinedale	1,327	\$240,336,818	\$147,225,462	\$387,562,280
Sublette Unincorporated	5,857	\$1,083,518,964	\$579,085,022	\$1,662,603,986
Total	7,925	\$1,411,434,177	\$777,827,338	\$2,189,261,515

Source: Wyoming CAMA 2021, Wood GIS Analysis

As presented in Table 6, total building exposure within Sublette County is over \$2.1 billion, with over \$1.4 billion in improved value and \$777 million of contents at risk. The greatest portion of susceptible structures are in the combined unincorporated areas followed by the Town of Pinedale.

Table 6 Sublette County Building Inventory and Value by Jurisdiction and Property Type

Jurisdiction	Property Type	Improved Parcels	Improved Value	Est. Content Value	Total Exposure
Big Piney	Commercial	43	\$5,216,364	\$5,216,364	\$10,432,728
	Residential	213	\$22,124,854	\$11,062,427	\$33,187,281
	Total	256	\$27,341,218	\$16,278,791	\$43,620,009
Marbleton	Commercial	82	\$10,238,950	\$10,238,950	\$20,477,900
	Residential	403	\$49,998,227	\$24,999,114	\$74,997,341
	Total	485	\$60,237,177	\$35,238,064	\$95,475,241
Pinedale	Commercial	198	\$54,114,105	\$54,114,105	\$108,228,210
	Residential	1,129	\$186,222,713	\$93,111,357	\$279,334,070
	Total	1,327	\$240,336,818	\$147,225,462	\$387,562,280
Unincorporated	Commercial	318	\$74,651,079	\$74,651,079	\$149,302,158
	Residential	5,539	\$1,008,867,885	\$504,433,943	\$1,513,301,828
	Total	5,857	\$1,083,518,964	\$579,085,022	\$1,662,603,986
Grand Total		7,925	\$1,411,434,177	\$777,827,338	\$2,189,261,515

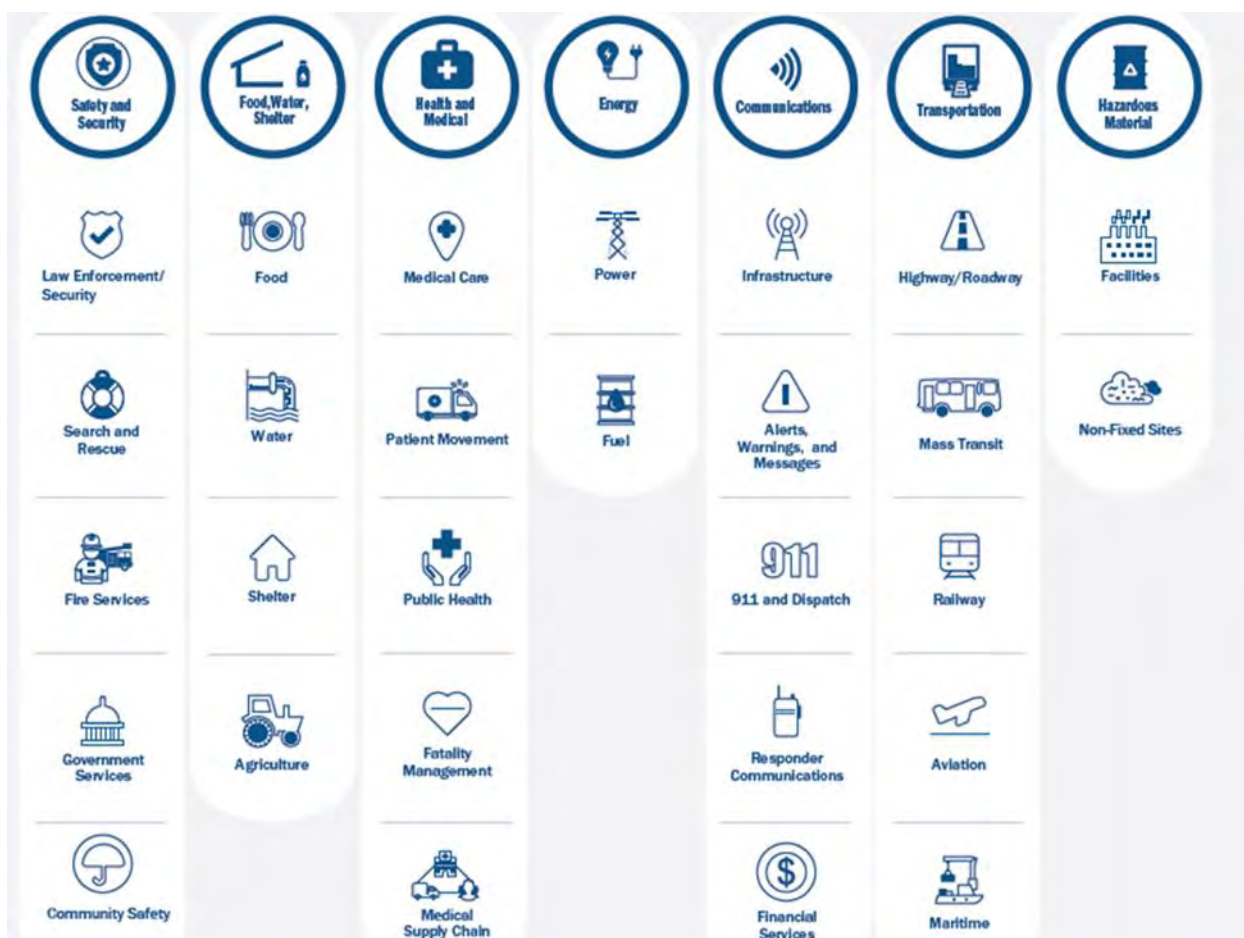
Source: Wyoming CAMA 2021, Wood GIS Analysis

Of the \$2.1 billion of exposure, residential buildings represent the largest amount of value, over \$1.9 billion in total exposure (86.8%). Commercial buildings account for \$288 million of total exposure (13.2%).

6.2.1 Critical Facilities, Infrastructure, and Other Important Community Assets

A critical facility is generally defined by FEMA as facilities and infrastructure that are critical to the health and welfare of the population and that are especially important following hazard events. Much of this data is based on GIS databases associated with the 2022 Homeland Infrastructure Foundation-Level Data (HIFLD). Other critical facility databases were also used, such as the National Bridge Inventory (NBI) and Wyoming State Assets, with supplementation from the HMPC.

FEMA organizes critical facilities into seven lifeline categories as shown in Figure 2.

Figure 2 FEMA Lifeline Categories

Source: FEMA

These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators).
- Enable integration of preparedness efforts among plans; easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

Table 7 summarizes critical facility counts in Sublette County, by jurisdiction, as provided by the County, HIFLD, NBI, and the Wyoming State Assets. Maps of critical facilities can be found in the flood and wildland fire vulnerability sections. Table 8 examines the distribution of critical facilities across each individual jurisdiction.

Table 7 Sublette County Total Facilities by Jurisdiction and FEMA Lifeline

Jurisdiction	Communications	Energy	Food, Water, Shelter	Hazardous Material	Health and Medical	Safety and Security	Transportation	Total
Big Piney	7	1	1	-	-	4	1	14
Marbleton	23	-	-	-	-	1	1	25
Pinedale	30	-	-	-	1	16	4	51
Unincorporated	381	7	-	6	-	6	97	497
Total	441	8	1	6	1	27	103	587

Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

Table 8 Sublette County Critical Facilities by Jurisdiction

Jurisdiction	Facility Type	Facility Count
Big Piney	Communications	7
Big Piney	Energy	1
Big Piney	Food, Water, Shelter	1
Big Piney	Safety and Security	4
Big Piney	Transportation	1
Marbleton	Communications	23
Marbleton	Safety and Security	1
Marbleton	Transportation	1
Pinedale	Communications	30
Pinedale	Health and Medical	1
Pinedale	Safety and Security	16
Pinedale	Transportation	4
Sublette Unincorporated	Communications	381
Sublette Unincorporated	Energy	7
Sublette Unincorporated	Hazardous Material	6
Sublette Unincorporated	Safety and Security	6
Sublette Unincorporated	Transportation	97

Source: Wyoming, HIFLD, NBI, WY State Assets, Wood GIS Analysis

6.2.2 Natural, Historic, and Cultural Assets

Assessing the vulnerability of Sublette County to disasters also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.

- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Historic and Cultural Resources

By definition, a historic property not only includes buildings of other types of structures, such as bridges and dams, but also includes prehistoric or Native American sites, roads, byways, historic landscapes, and many other features. Given the history of the County, these types of historic properties exist in the planning area.

Information about historic assets in Sublette County came from the following sources:

- The National Register of Historic Places is the Nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

Table 9 lists the properties and districts in Sublette County that are on the National Register of Historic Places.

Table 9 Sublette County Historic Properties

Site	Jurisdiction
Circle Ranch	Big Piney
Wardell Buffalo Trap	Big Piney
Archeological Site No. 48SU354	Big Piney
Church of St. Hubert the Hunter and Library	Bondurant
DDZ Bridge over New Fork River	Boulder
Steele Homestead	Boulder
New Fork	Boulder
Jensen Ranch	Boulder
Green River Drift Trail Traditional Cultural Property	Cora
ENP Bridge over Green River	Daniel
Upper Green River Rendezvous Site	Daniel
Father DeSmet's Prairie Mass Site	Daniel
Daniel School	Daniel
Redick Lodge	Pinedale
Fort Bonneville	Pinedale
Log Cabin Motel	Pinedale
Trappers Point Site	Pinedale
Sommers Ranch Headquarters Historic District	Pinedale

Sources: National Register Information System, www.nr.nps.gov/

Natural Resources

Natural resources are important to include in benefit-cost analyses for future projects and may be used to leverage additional funding for projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives.

For instance, protecting wetlands areas protects sensitive habitat as well as attenuates and stores floodwaters.

Wetlands

Wetlands are a valuable natural resource for communities, due to their benefits to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water. They also provide drought relief in water-scarce areas where the relationship between water storage and streamflow regulation are vital. Wetlands in the County include riparian areas that are typically populated with willows. The presence of willows is often a good indicator of a floodplain within the County.

Endangered Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the planning area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

There are ten federally-recognized endangered, threatened, or candidate species in Sublette County according to the U.S. Fish and Wildlife Service. These species are listed in Table 10 along with State listed species. The grizzly bear and gray wolf are two species that have recovered and are no longer listed.

Table 10 **Endangered and Threatened Species in Sublette County**

Common Name	Scientific Name	Type of Species	Status
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Birds	Recovery
Yellow-Billed Cuckoo	<i>Coccyzus americanus</i>	Birds	Threatened
Whitebark Pine	<i>Pinus albicaulis</i>	Conifers and Cycads	Candidate
Kendall Warm Springs Dace	<i>Rhinichthys osculus thermalis</i>	Fishes	Endangered
Ute ladies'-Tresses	<i>Spiranthes diluvialis</i>	Flowering Plants	Threatened
Black-Footed Ferret	<i>Mustela nigripes</i>	Mammals	Endangered
Canada Lynx	<i>Lynx canadensis</i>	Mammals	Threatened
North American Wolverine	<i>Gulo luscus</i>	Mammals	Proposed Threatened

Source: <http://www.fws.gov/endangered/>

6.3 Vulnerability to Specific Hazards

This section details vulnerability to specific hazards, where quantifiable, only where it differs from that of the Region. For a discussion of the methodology used to develop the loss estimates refer to Chapter 4 of the base plan. In many cases Chapter 4 contains information that differentiates the risk by county thus the information is not duplicated here. For most of the weather-related hazards the risk does not vary significantly enough from the rest of the Region and thus the reader should refer to Chapter 4. Only unique issues or vulnerabilities are discussed, where applicable.

6.3.1 Avalanche

Generally, avalanches occur in remote areas and have little impact, except when unwary backcountry travelers get caught and buried. Avalanches cause two primary consequences for Sublette County: roadblocks and death or injury to backcountry users. Due to these impacts and impacts on search and rescue personnel avalanches are a high significance hazard for the County, but low for the municipalities.

- The Sublette County HMPC notes closures of Hwy 191 to Jackson periodically for mitigation and backcountry user impacts.
- Sublette County has had five avalanche-caused deaths in the past 33 years. These fatalities occurred to backcountry skiers in the Gros Ventre and Wyoming Ranges.
- There are costs associated with "search and rescue" and removal of the injured or deceased.
- Roadblocks are another major concern where roads intersect an avalanche path. The major costs associated with roadblocks are snow removal and traffic diversion, which both necessitate personnel and equipment.
- Road closures impact commerce, we have a considerable portion of the population that commutes to Teton County for employment.
- Obstacles resulting from avalanches can interrupt delivery of goods and services from Idaho on highways through Teton County.
- Due to their steep terrain, high elevations, and winter snows, parts of the County experience avalanches every winter, the most susceptible areas are the Wind River, Gros Ventre, and Wyoming Range Mountains.

6.3.2 Dam Failure

Sublette County has 28 dams that are inspected by the Wyoming State Engineer's Office. Of the 28, four are considered high hazard and two are significant hazard dams, the rest being low hazard dams.

- Sublette County has documented only one dam failure, that of the New Fork Dam in January, 1948. Impacts of the 1948 New Fork Dam failure included several miles of destroyed fencing below the dam and the loss of approximately 200 yearling cattle.
- With five high or significant hazard dams within the County there is a possibility of dam failure flooding in the future. Development or future development along portions of the West Fork of the New Fork River, Middle Piney Creek, Lake Creek, Boulder Creek, or Spring Creek could be at risk to dam failure flooding.
- The Sublette County HMPC noted Fremont Lake as a concern due to its proximity to Pinedale. It is primarily a natural lake, that has had some enhancement for storage and there is no means to regulate flow from the lake during high runoff years.
- Of the County's jurisdictions, Big Piney is more vulnerable to dam failure due to its proximity to one high hazard dam (Middle Piney Lake Dam) and one significant dam (Sixty Seven).

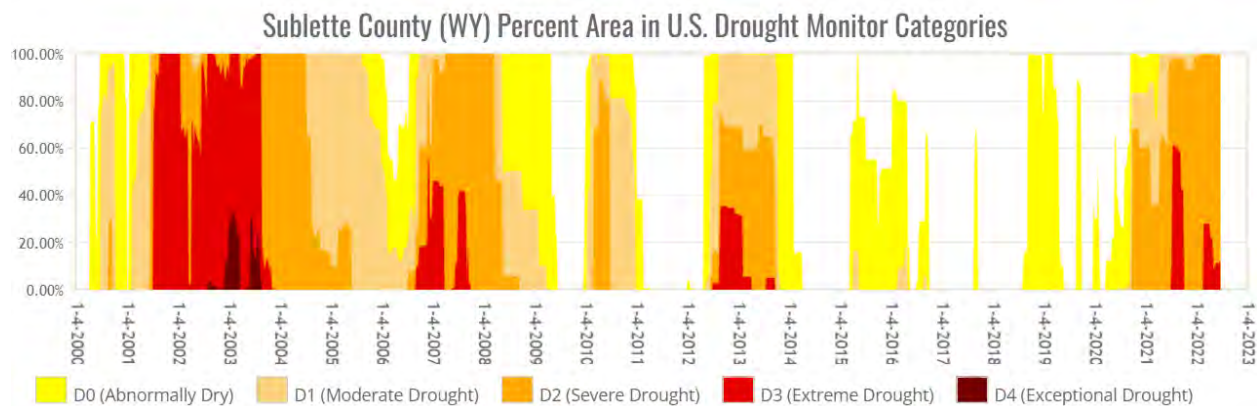
6.3.3 Drought

Similar to the rest of the Region drought is a high significance hazard for the County. Since 2012 there have been 11 USDA Disaster Designations in Sublette County for drought. According to the U.S. Drought Monitor records for Sublette County, in the 1,147-week period from 2000 through 2021, the County spent 880 weeks (77% of the time) in Abnormally Dry (D0) conditions. Approximately 60% of the time, or 684 weeks, was spent in Moderate Drought (D1) conditions. Weeks in drought between 2000 and 2020 are summarized in Table 11 and shown in time series from January 2000 and May 31, 2022, in Figure 3.

Table 11 Sublette County Weeks in Drought by Intensity, 2000-2021

Category	Description	Palmer Drought Severity Index (PDSI)	Standardized Precipitation Index (SPI)	Sublette County Weeks in Drought, 2000-2021
D0	Abnormally Dry	-1.0 to -1.9	-0.5 to -0.7	880
D1	Moderate Drought	-2.0 to -2.9	-0.8 to -1.2	684
D2	Severe Drought	-3.0 to -3.9	-1.3 to -1.5	474
D3	Extreme Drought	-4.0 to -4.9	-1.6 to -1.9	237
D4	Exceptional Drought	-5.0 or less	-2.0 or less	49

Source: U.S. Drought Monitor

Figure 3 Sublette County Drought Intensity, 2000, May 31, 2022

Vulnerability is tempered somewhat by the County being a headwaters area. The snowpack in the Wind River Range helps feed rivers, lakes and streams during normal years, but can be affected by dry, low snowpack years. Drought-related impacts to the local economy can be extensive to tourism and industry from increased wildfire danger, forest closures and fire bans. The overall significance of drought is consistently high throughout Sublette County and across jurisdictions. Big Piney and Marbleton use wells as the water source. Potable water for the Town of Pinedale comes from Fremont Lake which includes thousands of acre feet of storage in the Pinedale Municipal System.

Refer to Chapter 4 in the Base Plan for additional discussion of drought risk related to the Region and the County.

6.3.4 Earthquake

As discussed in Chapter 4 earthquakes are medium probability but could have considerable impacts in Sublette County. Refer to Chapter 4 for details on economic losses from Hazus analysis. The LEPC noted the following historic earthquake events in Sublette County.

- Prior to 1960, there were five recorded earthquakes (1936, 1945, 1951), all of which registered as intensity III. These events occurred in southeastern and southwestern Sublette County.
- Four more earthquakes were detected in Sublette County in the 1960s, but no one reported feeling the earthquakes and no damage was reported (United States Geological Survey [USGS] National Earthquake

Information Center). These earthquakes registered with magnitudes between 2.5 and 2.8, all of which occurred near Calpet.

- In the 1970's, there were three earthquakes that occurred in southwestern Sublette County. The earthquakes were detected near Big Piney (10-15 miles away), and registered with magnitudes ranging from 3.3 to 4.2.
- There was only one earthquake recorded in 1980; a magnitude 3.6 located 4.5 miles north-northeast of Bondurant.
- On June 27, 2000, the University of Utah Seismograph Stations detected a magnitude 2.7 earthquake in southwestern Sublette County, approximately 8 miles north-northeast of Calpet.
- Most recently, on September 27, 2001, an earthquake was recorded near the Fremont County-Teton County-Sublette County borders. Area residents reported feeling this magnitude 4.3 event that was centered approximately 25 miles northeast of Bondurant (USGS National Earthquake Information Center).
- Intensity VIII Earthquake Areas (Bondurant): Intensity VIII earthquakes can result in considerable damage in ordinary buildings and great damage in poorly built structures. Panel walls may be thrown out of frames. Chimneys, walls, columns, factory stacks may fall. Heavy furniture may be overturned.
- Intensity VII Earthquake Areas (Big Piney, Big Sandy, Boulder, Calpet, Cora, Daniel, Marbleton, Merna, Pinedale): In intensity VII earthquakes, damage is negligible in buildings of good design and construction, slight-to-moderate in well-built ordinary structures, considerable in poorly built or badly designed structures such as un-reinforced masonry buildings. Some chimneys will be broken.
- It is estimated that in a 2,500-year earthquake event (2% probability of being exceeded in 50 years), Sublette County would sustain \$113 million in total losses. In this scenario, Sublette County is ranked 8th in Wyoming when comparing damages and fatalities across the State. It is also worth noting that the estimated losses in this scenario would give Sublette County a loss ratio (total damage compared to the total building and facility inventory value in the County) of 4.8% which would be the 4th highest loss ratio in the State. The most geologically active areas are centralized around the Western Wyoming/Teton Region, or around the fault lines in Fremont County, and thus the potential is more limited in Sublette. Earthquake risk is consistent across the County and jurisdictions.

There have been 19 magnitude 2.0 or intensity III and greater earthquakes recorded in Sublette County. The following paragraphs describe several past events of note, either because they caused damage or were significant enough to be noticeable:

On February 21, 1951, the USGS National Earthquake Information Center reported that an intensity III earthquake occurred in Sublette County. A check of the original reference and description of this event, however, suggests a location error, as only three people in Rock Springs felt the earthquake (Murphy and Cloud, 1951). The epicenter of this earthquake will therefore be tentatively located in northwestern Sweetwater County.

No other earthquakes were recorded in the County until the 1960s. A magnitude 4.3, intensity V earthquake occurred in southeastern Sublette County on February 25, 1963, approximately 15 miles north-northeast of Big Sandy. The earthquake was felt for over a minute in Atlantic City, and for approximately six seconds in the Lander and Hudson areas (Casper Star-Tribune, February 26, 1963). Windows, doors, and dishes were rattled in Fort Washakie as a result of the earthquake (von Hake and Cloud, 1965).

Four more earthquakes were detected in Sublette County in the 1960s, but no one reported feeling the earthquakes and no damage was reported (USGS National Earthquake Information Center). On July 31, 1965, a magnitude 2.8 earthquake occurred in western Sublette County, approximately 9 miles northwest of Calpet. A magnitude 2.7 earthquake occurred on August 18, 1967, approximately 7 miles northwest of

Calpet. On December 18, 1967, an earthquake of no specific magnitude or intensity was recorded in northeastern Sublette County, which was centered approximately 34 miles northeast of Bondurant. On June 6, 1969, a magnitude 2.5 earthquake was recorded in the southern portion of the County, approximately 5 miles west of Calpet. Again, no one reported feeling these 1965 - 1969 earthquakes in Sublette County (USGS National Earthquake Information Center).

In December 1971, two earthquakes occurred in southwestern Sublette County. On December 2, 1971, a magnitude 4.1 earthquake was detected approximately 15 miles southwest of Big Piney. A day later, on December 3, 1971, a magnitude 4.2 earthquake was recorded approximately 12 miles southwest of Big Piney. No one reported feeling either event (USGS National Earthquake Information Center). A magnitude 3.3 earthquake was detected in the same area on February 6, 1978. No one felt this earthquake, which was centered approximately 13 miles southwest of Big Piney (USGS National Earthquake Information Center).

Only one earthquake was recorded in the County in the 1980s. On October 21, 1988, a magnitude 3.6 earthquake occurred near the Teton County – Sublette County border. The epicenter of this earthquake was located approximately 4.5 miles north-northeast of Bondurant. No one felt this earthquake (USGS National Earthquake Information Center).

Three earthquakes occurred in Sublette County in the 1990s. A magnitude 2.9 earthquake was reported on September 4, 1993, in southern Sublette County. No one reported feeling this earthquake that was centered approximately 2 miles north-northeast of Calpet. On October 21, 1996, a magnitude 3.7 earthquake was recorded approximately 13 miles southeast of Big Sandy. No one felt this earthquake and no damage was reported (USGS National Earthquake Information Center). On November 16, 1999, a magnitude 3.1 event occurred on the Teton County – Sublette County border. Again, no one felt this earthquake that was centered approximately 9 miles north-northeast of Bondurant. (USGS National Earthquake Information Center).

On June 27, 2000, the University of Utah Seismograph Stations detected a magnitude 2.7 earthquake in southwestern Sublette County, approximately 8 miles north-northeast of Calpet. No one reported feeling this event (USGS National Earthquake Information Center).

On September 27, 2001, an earthquake was recorded near the Fremont-Teton-Sublette County borders. Area residents reported feeling this magnitude 4.3 event that was centered approximately 25 miles northeast of Bondurant (USGS National Earthquake Information Center).

Two earthquakes were recorded in northern Fremont County on April 26, 1967. A magnitude 4.7 event and a magnitude 4.2 event occurred approximately 32 miles southwest and approximately 38 miles west-southwest of Thermopolis, respectively (Reagor, Stover, and Algermissen, 1985). No damage was associated with either earthquake.

On August 7, 1991, a magnitude 3.5 earthquake was recorded in northern Fremont County, approximately 35 miles southwest of Thermopolis. This non-damaging earthquake was felt in Thermopolis.

A magnitude 3.0 earthquake occurred on November 8, 2000, in northeastern Fremont County. This event was centered approximately 29.5 miles southeast of Thermopolis. No one reported feeling this earthquake (USGS National Earthquake Information Center).

HMPC members and residents of the Wind River Reservation noted feeling an earthquake that occurred west of Fort Washakie in 2015.

6.3.5 Expansive Soils

There are expansive soils located in Region 5, however, Sublette County is less susceptible to expansive soils when compared to Fremont County and the Wind River Reservation. Potential for swelling is predominantly low/moderate for the County and associated impacts are negligible. While there are areas of potential risk that are identified, the Sublette HMPC indicated that this hazard presents little to no impact. Overall, expansive soils are a low significance hazard across the County and does not vary between the jurisdictions. See Chapter 4 for more information on the location of various soil types, probability of expansion, and exposed building values.

6.3.6 Extreme Cold

Based on data provided by the Sublette HMPC and historical records, extreme cold is an annual occurrence for the County. Though the probability of this is highly likely, damages or lives lost occur less often. Extreme cold can cause a problem for utility infrastructure and communications, as well as livestock and crops. Since 2012 Sublette County has received one USDA Disaster Designation for freeze or frost. There is always a risk to people, however, danger is higher for the elderly, children, people in poor health, or individuals living without adequate shelter/heating. The overall significance of this hazard is low across the County and does not vary between the jurisdictions. Refer to Chapter 4 of the base plan for more information.

6.3.7 Flood

According to the National Flood Insurance Program (NFIP) Community Status Book, Sublette County joined the NFIP in 1994. Details on NFIP participation and flood map status are provided in the table below. Big Piney has no Special Flood Hazard Area, or 100-year floodplain. The Town of Pinedale is suspended from the NFIP, which means that the community has been non-compliant with the program and that residents cannot purchase flood insurance. The town has concerns about regulating with old and inaccurate maps but is considering joining and creating a mitigation action related to both these topics in 2022.

Table 12 NFIP Status in Sublette County

Community	Date of entry into program	Current effective map date
Unincorp. Areas	7/13/1994	11/15/1977
Big Piney	2/2/1984	(NSFHA)
Marbleton	Not mapped	Not mapped
Pinedale	3/18/1986	8/15/89 (Suspended community)

Sources of flooding in Sublette County include Barber Creek, Middle Piney, South Piney, and North Piney Creeks, Pine Creek, Boulder Creek, Spring Creek, Lake Creek, West Fork of the New Fork River, the Green River, the Hoback River and other small creeks, washes, and drainages. The Boulder Lake Dam provides watershed and flood protection in Sublette County. The project was completed in 1970 by the Natural Resources Conservation Service and provides flood protection to the community of Boulder.

The flood history shows that floods have occurred occasionally in Sublette County, but impacts have been minimal. The frequency of floods since 1995 has been approximately every other year. There has been no loss of life or any significant injury caused by floods in the County.

GIS analysis was used to estimate Region 5's potential property and economic losses during the 2022 update, see Section 4.2.5 in the base plan for specifics and results. Based on this analysis, in the event of a 100-year flood (1% annual chance), most impacted buildings are in the unincorporated areas (94.02%), followed by Pinedale (5.74%), and Big Piney (0.24%).

Maps of the flood hazard for the County and applicable jurisdictions are provided here. The HMPC considers the FEMA mapping to be in need of updating, which is noted as a need in mitigation strategy.

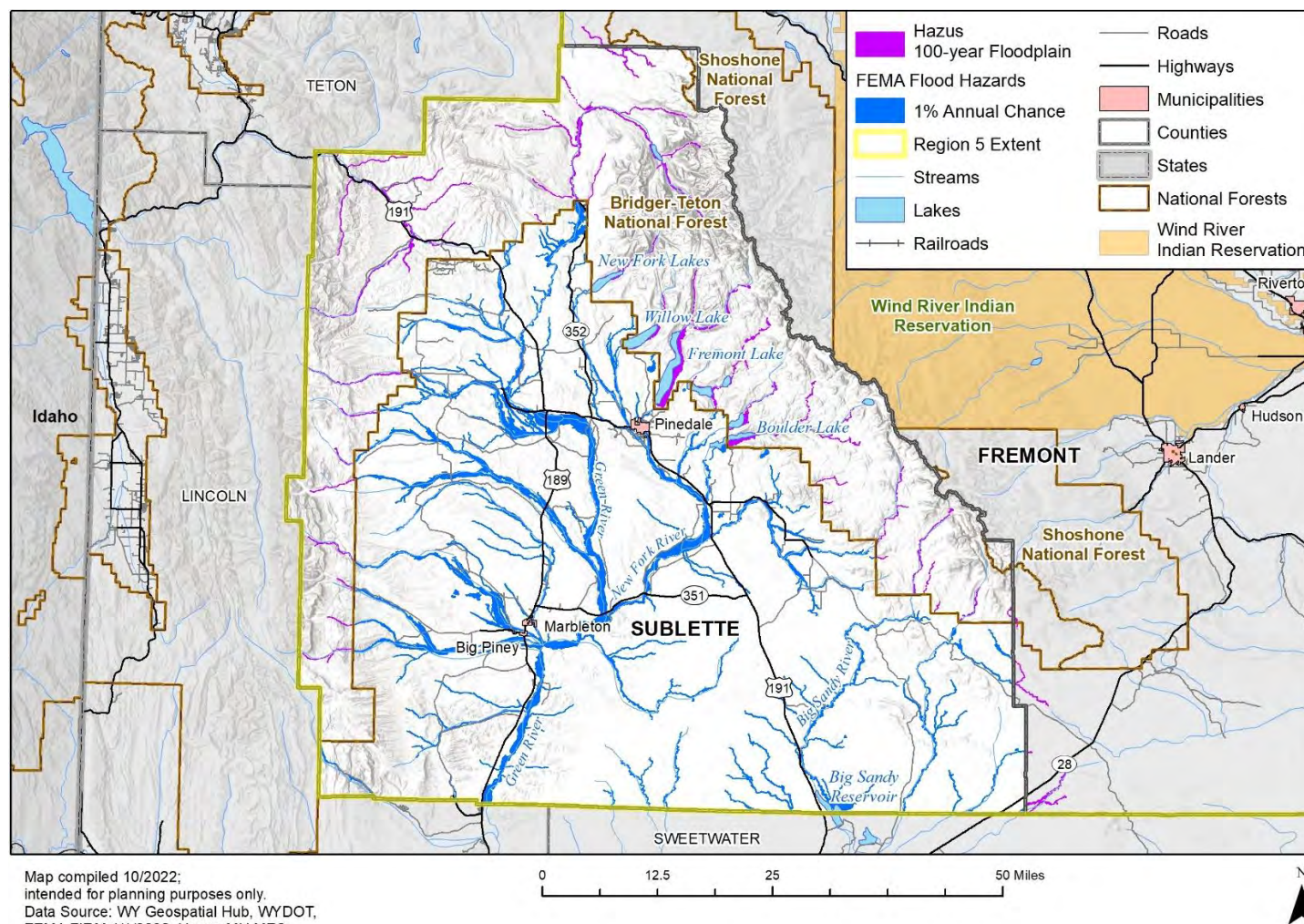
Figure 4 Sublette County FEMA and Hazus Flood Hazards

Figure 5 Pinedale FEMA Flood Hazards



Figure 6 Town of Big Piney FEMA Flood Hazards

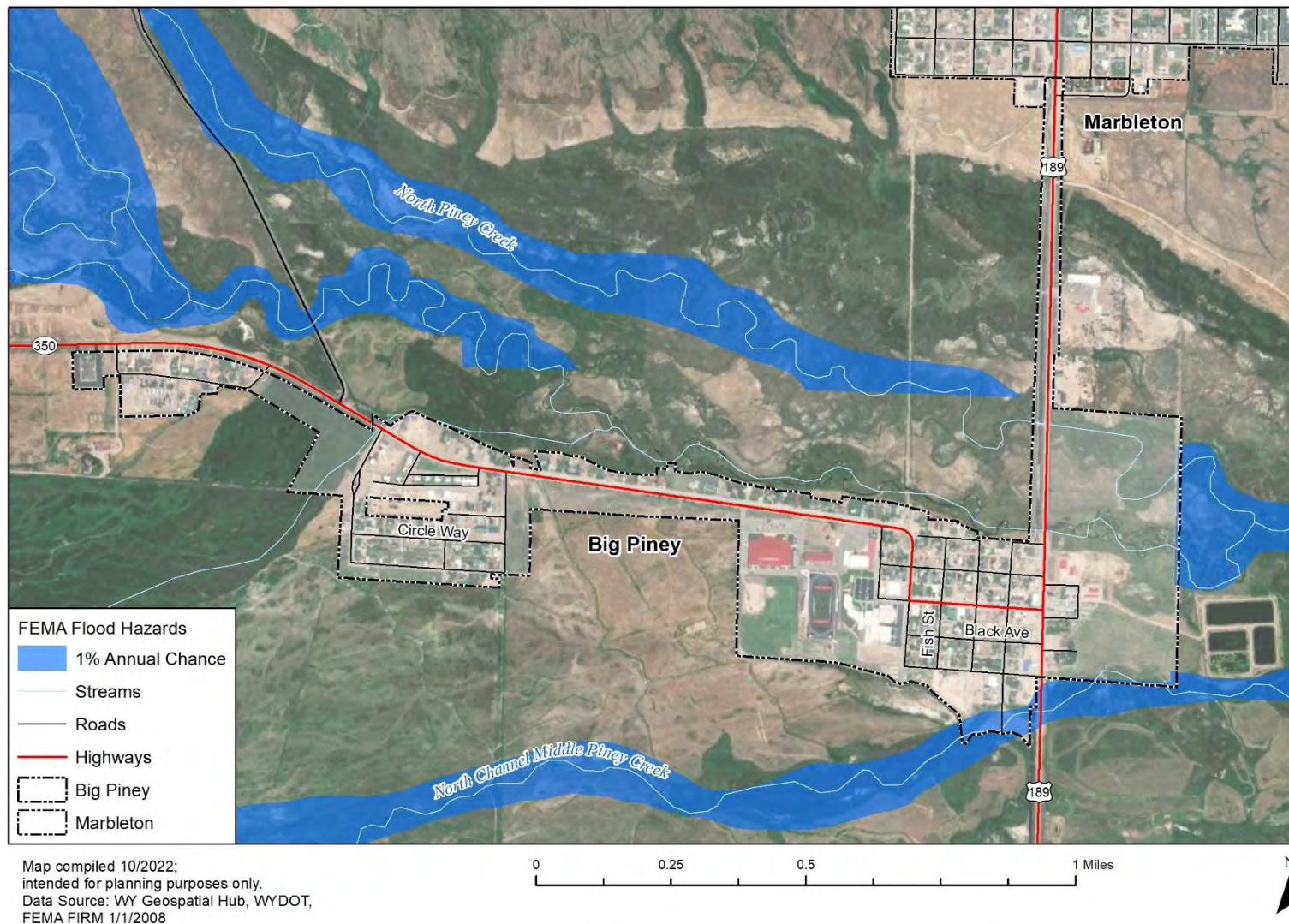


Figure 7 Town of Marbleton FEMA Flood Hazards



6.3.8 Hail

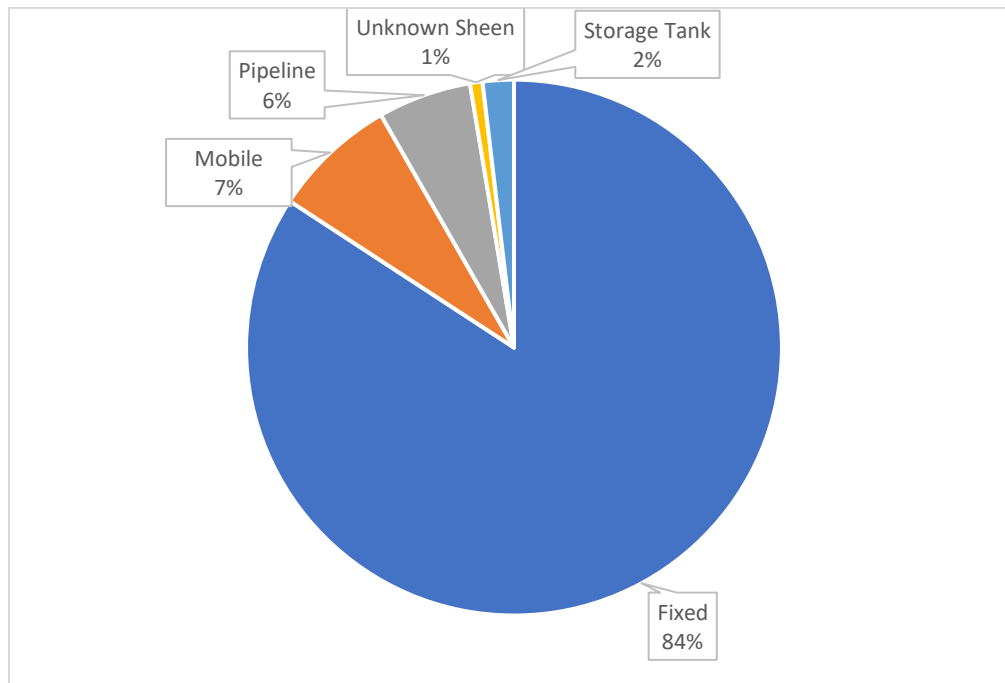
Hailstorms occur sporadically throughout Region 5, and primarily impact buildings and agriculture. While the USDA dataset had no reported crop losses in Sublette County, the National Centers for Environmental Information (NCEI) dataset reported 14 hail events in the County between 1955 and 2021. No monetary losses were reported in Sublette County, but that is more likely due to damages from hail going unreported, rather than Sublette having no losses from hail at all.

Despite no damage being reported in Sublette County due to hail, there is potential for significant structural destruction from particularly large hailstones. There have been 4 reported incidents of significant sized hail in Sublette County over the past 66 years: 3 ping-pong ball sized hail (1.5 inches) and one incident of golf ball sized hail (1.75 inches). The probability of future occurrences for this event is likely, but the magnitude of these events is limited. Overall, hail poses a medium threat across the County and does not vary between the jurisdictions. Though it should be noted that property damage will be higher in the municipalities, but potential crop damage would be concentrated in the rural unincorporated areas. See Chapter 4 of the base plan for more information on the previously recorded hail events and associated damages.

6.3.9 Hazardous Materials

There are four Risk Management Plan (RMP) facilities listed in Sublette County, of which one is in Pinedale and one is in Big Piney. Vulnerability to hazardous materials includes transportation and fixed facilities. The Sublette County HMPC noted that there have been no commodity flow studies conducted in the County, so the types and amounts of materials being transported are not known. However, transportation routes of hazardous materials indicate that Pinedale is susceptible to transportation incidents due to Highway 191 passing through town, and Big Piney and Marbleton have potential for transportation incidents related to Highway 189. According to the National Response Center database between 1990 and 2021, there have been 266 hazardous materials incidents in Sublette County. Fixed facilities were the most common incident type followed by pipeline incidents. In 2022 the HMPC noted that with a nuclear power plant going in at Kemmerer there will be certain hazards possible from wind carried fallout (to be worked through in the 2022 THIRA).

Figure 8 Hazardous Materials Incidents Reported to NRC by Type – Sublette County, 1990-2021



Source: NRC

Refer to Chapter 4 for a discussion of hazardous materials risk in the Region and County.

6.3.10 High Winds and Downbursts

Wind is a constant presence in Wyoming and the Sublette HMPC noted that high winds are a consistent issue for the County. It is difficult to assess vulnerability as it relates to location because damaging winds have occurred everywhere in the Region. The main risks associated with high wind events are related to poorly constructed buildings, flying debris, car accidents, and damages to electrical/power infrastructure. High wind events are often somewhat random and damages from high winds are often described in a regional context, though downbursts occur in smaller extents.

In total, 110 severe wind events (including thunderstorm and high wind events) and \$1,040,200 in property damages have been documented in Sublette County between 1955-2021, based on the NCEI. The max wind speeds reported in the County reached 112.8 mph. One of the most significant wind events in the County occurred in July 1998, when severe winds caused extensive damage to a school roof located in Big Piney. Damages from the event totaled \$400,000. The probability of future wind events in Sublette County is likely, but the severity of events is negligible. Overall, severe winds pose a medium threat across the County and do not vary between the jurisdictions. See Chapter 4 of the base plan for more information on wind zones, events, and impacts.

6.3.11 Landslide/Debris Flow/Rockfall

Wyoming has a very diverse and extensive geologic history, resulting in a variety of different geologic hazards that impact Region 5. Landslides both within the County and in adjacent counties have caused impacts, which are summarized below:

- The primary concern associated with these events are the implications for infrastructure, particularly roadways. In Sublette County, the area of concern is along Highway 191, a major artery to Teton and Yellowstone National Parks, near Bondurant. Bondurant is at the confluence of the Hogback River and its South Fork and within the Gros Ventre Wilderness. The highway cuts through the mountains and is surrounded by steep cliffs on either side. Landslides in Teton County along Highway 191 can also impact the flow of traffic and goods into Sublette County.
- The HMPC noted that Stewart Point south of Pinedale has evidence of landslides. A United States Forest Service (USFS) representative noted that many Forest Service roads are at risk in Sublette County.
- The Pass Creek quadrangle has development occurring that is near potential landslide areas.
- Numerous landslides are present in Sublette County. Specifically, landslides are present on the following quadrangles:

Big Sheep Mountain	Halfway	Pine Grove Ridge
Bondurant	Halls Mountain	Prospect Peak
Boulder Lake	Hoback Peak	Raspberry Ridge
Bridger Lakes	Horseshoe Lake	Red Castle Creek
Bull Creek	Kendall Mountain	Roberts Mountain
Clause Peak	Kismet Peak	Scab Creek
Coal Creek	Klondike Hill	Signal Hill
Cretaceous Mountain	Lake Mountain	Springman Creek
Deer Hill	Lizard Head Peak	Squaretop Mountain
Dodge Butte	Lookout Mountain	Sweetwater Gap
Doubletop Peak	Maki Creek	Temple Peak
Downs Mountain	Meadow Canyon	The Hogsback
Fayette Lake	Merna	Tosi Peak
Fish Creek Park	Mount Bonneville	Triple Peak
Fremont Lake North	Mount Schideler	Union Peak
Fremont Lake South	Mount Thompson	Warren Bridge
Fremont Peak South	New Fork Lakes	Webb Draw
Gannett Peak	Noble Basin	Wyoming Peak
Granite Falls	Onion Springs	
Green River Lakes	Pass Peak	

In terms of significance, landslides, debris flow, and rockfall vary based on the magnitude and the location. There is also a possibility that creeks or rivers within the County could become dammed by landslide activity, resulting in a flash flood hazard downstream if the landslide dam fails or is overtopped, or flood nearby developed areas as pooling behind the landslide dam occurs. While some events are small and have limited impact on people and infrastructure, other occurrences can involve large sections of earth and may obstruct major roadways, power line corridors, or gas lines.

As the Town of Pinedale has grown, the risk of landslides along the eastern hillside of the municipality has increased. Saturated granitic soils from upland irrigation, subdivision septic system percolation and stormwater runoff have charged the hillside seeps into measurable quantities of discharge. The sloughs and scarps are more evident and will continue to increase as the town grows.

Rio Verde Engineering, Jorgenson Engineering and Nelson Engineering have all done geotechnical surveys and bore sampling which confirm the glaciation formation and the subsequent scarps that have ensued from these water sources. The current locations are: 1) the Orcutt Hill Seep in Shelter Park that carries hundreds of gallons to the Town of Pinedale sewer system during the fall, winter and spring when the Pine Creek Canal No. 1 head gate is closed, 2) the hillside seeps that exist from the Shelter Park Bridge to the Fremont Lake Road bridge, 3) the stormwater drainage from the Clinic & Museum, Skyline Apartments and Burzlander Park and 4) the most recent hillside scarp on the Delgado Property south of the Town of Pinedale.

The HMPC also noted several potential impacts of landslides in the County, including risk of hillside collapse, damage to the Town of Pinedale water and sewer mains in the current Delgado scarp, potential harm to pedestrians and recreationalists with closure of the foot paths and bicycle paths that traverse the hillside through the municipality, and risk near utility lines which run over or above the Pine Creek Canal No. 1 where water is allowed to percolate.

During the 2022 development of this Regional Plan a GIS analysis of exposure to landslide hazard areas was performed, with the results detailed in Chapter 4 of the base plan. Sublette County has a moderate degree of landslide vulnerability, with 200 parcels or 5% of total parcels in the County are located in the highest landslide susceptibility areas, all are located in unincorporated Sublette County. The geospatial distribution of landslide susceptibility can be seen in the figures below. Figure 9

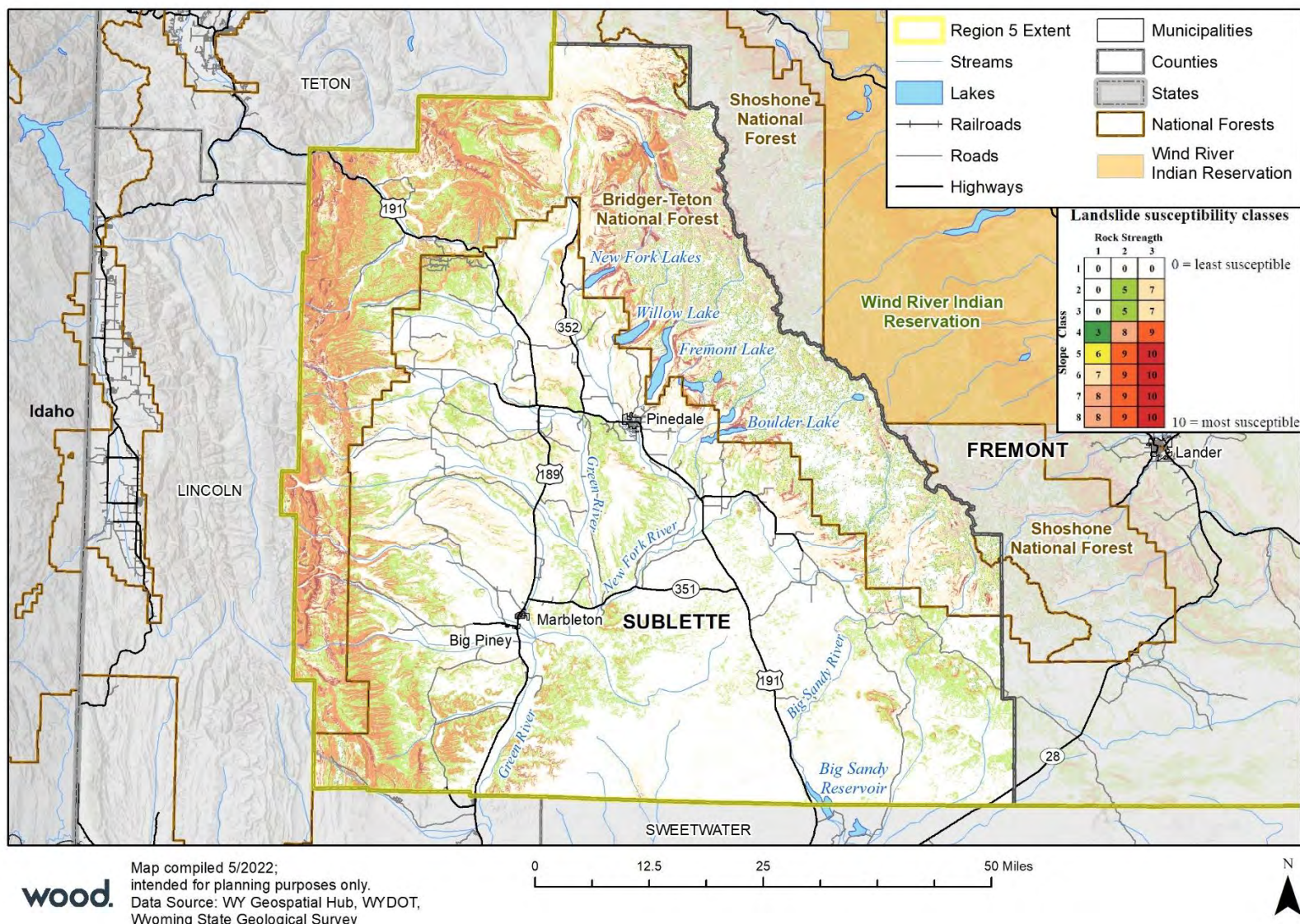
Figure 9 Sublette County Landslide Hazards

Figure 10 Town of Big Piney Landslide Hazards

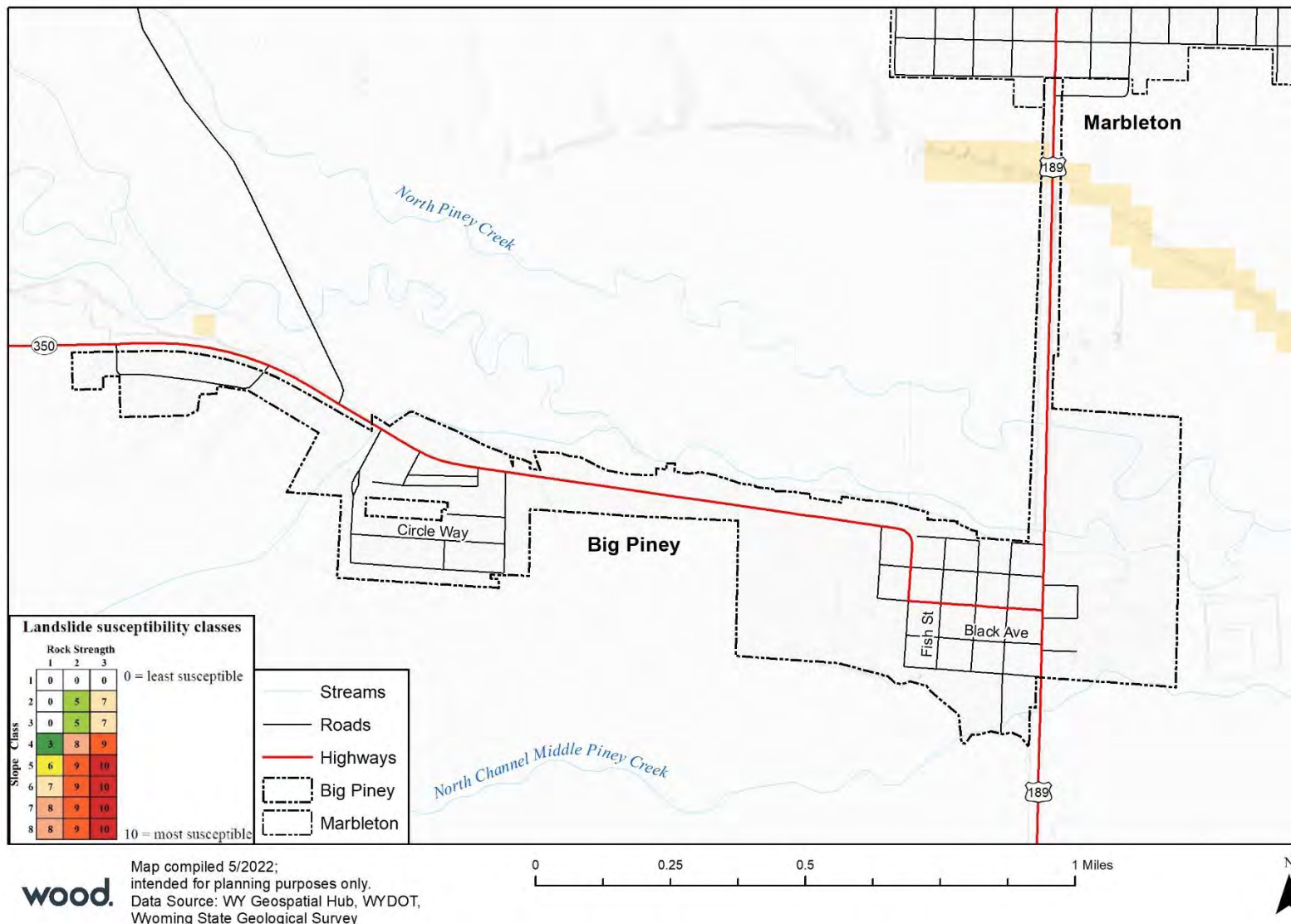


Figure 11 Town of Marbleton Landslide Hazards

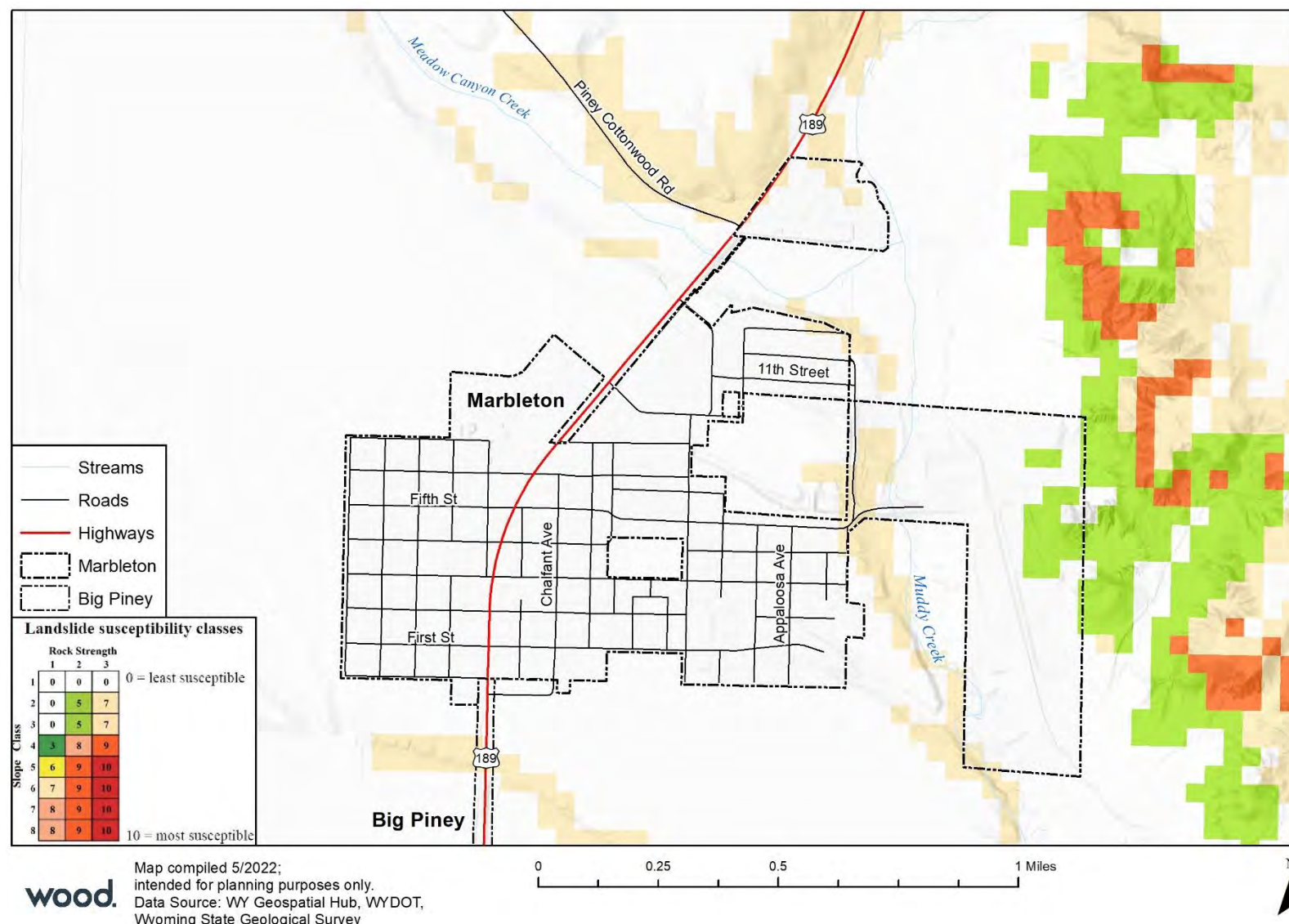


Figure 12 Town of Pinedale Landslide Hazards

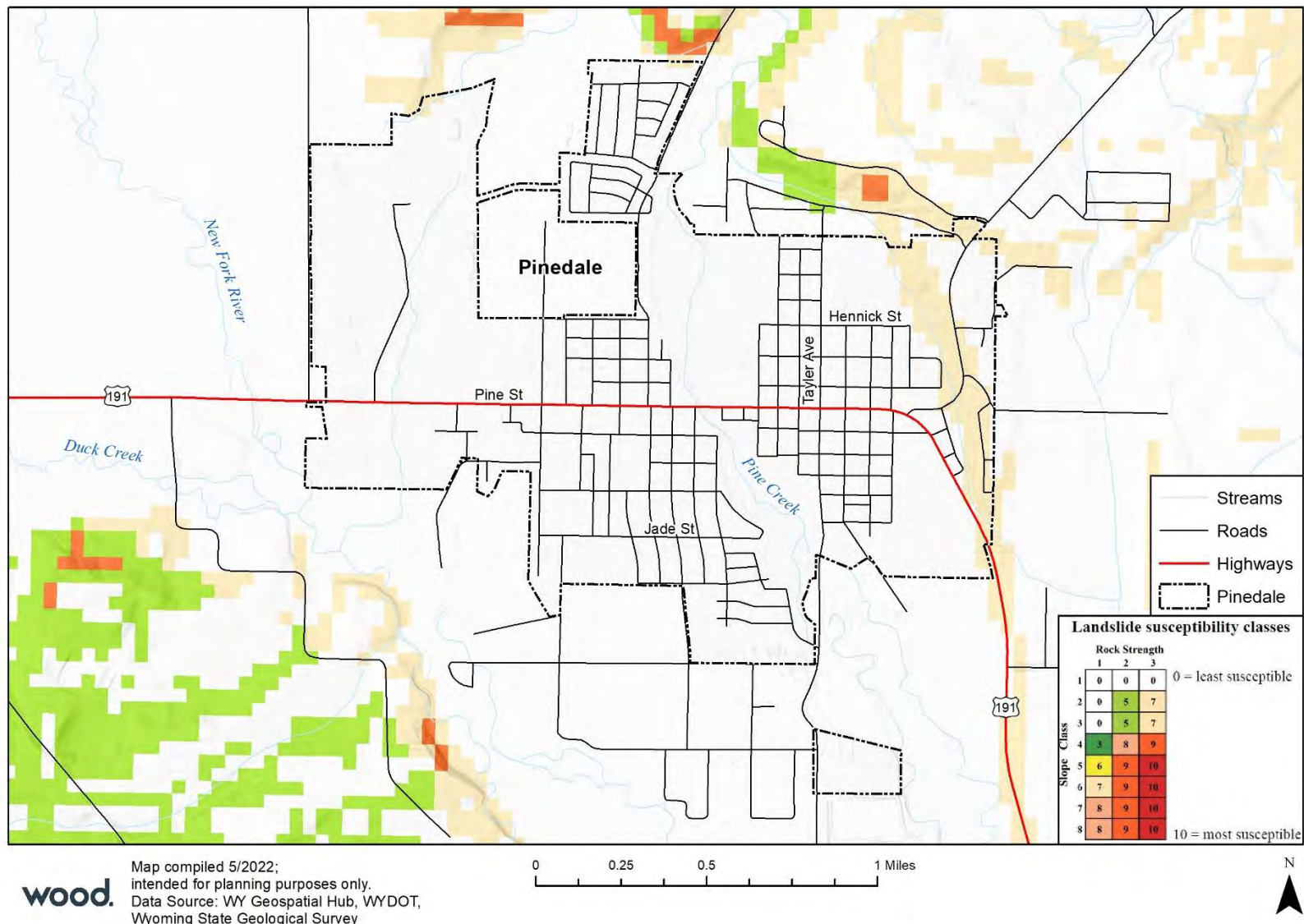
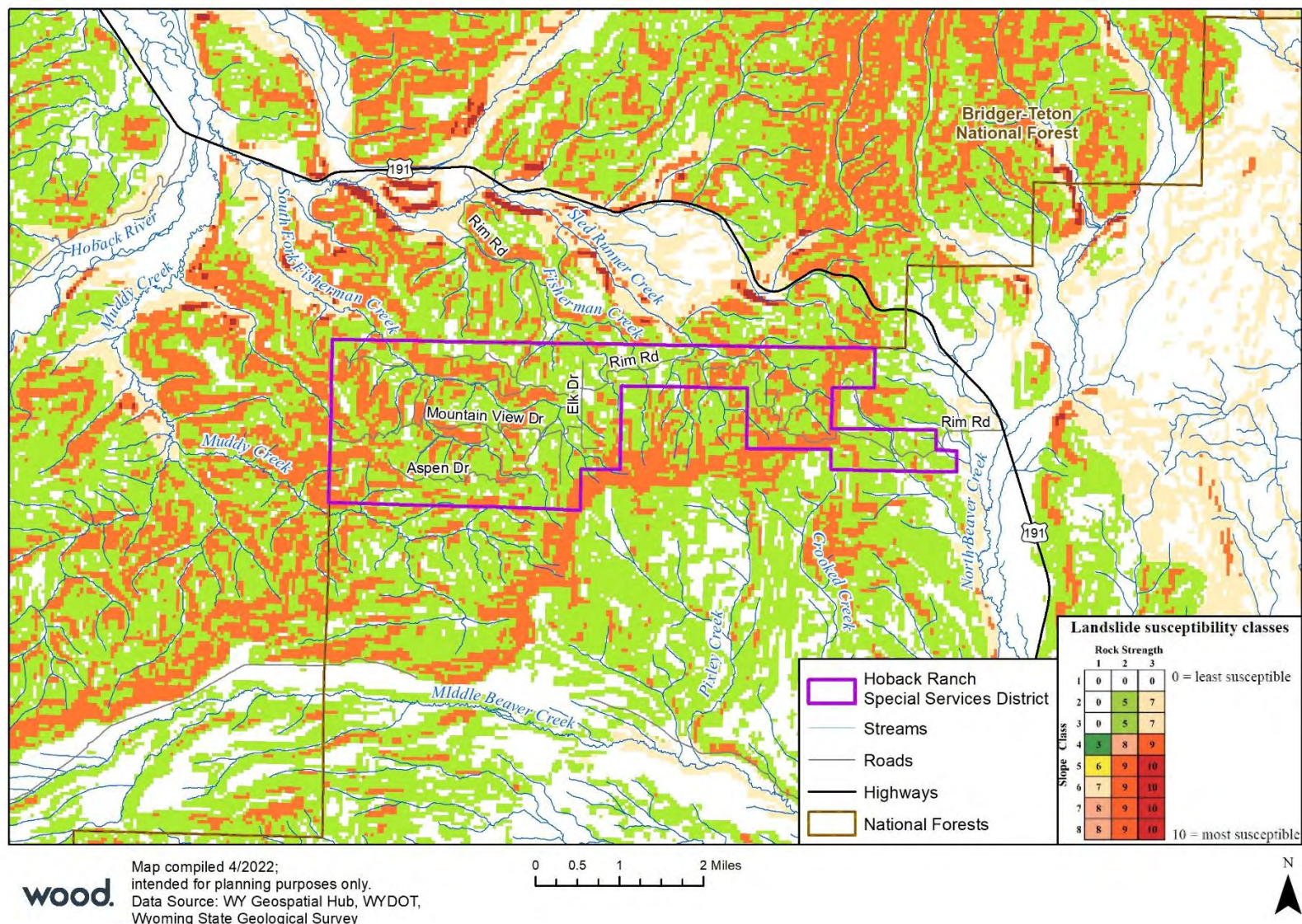


Figure 13 Hoback Ranches Special Improvement District Landslide Hazards



In terms of significance, landslides, debris flow, and rockfall vary based on the magnitude and the location. There is also a possibility that creeks or rivers within the County could become dammed by landslide activity, resulting in a flash flood hazard downstream if the landslide dam fails or is overtopped, or flood nearby developed areas as pooling behind the landslide dam occurs. While some events are, small and have limited impact on people and infrastructure, other occurrences can involve large sections of earth and may obstruct major roadways, power line corridors, or gas lines.

6.3.12 Lightning

Damaging lightning events occur about every seven years in the County. Impacts to persons and property are likely to remain isolated, however. Outdoor workers and outdoor enthusiasts and livestock will remain susceptible to lightning strikes. Wildland fires caused by lightning may result in more extensive damage. Lightning has caused death, injuries, and sparked numerous wildfires within Sublette County.

The NCEI dataset reports four of the eight recorded lightning events in the planning area occurred in Sublette County. Several of these lightning events caused significant impacts, such as five injuries and one death, as well as \$3,000 in property damages and \$42,000 in crop damages. The \$3,000 in property damage occurred in June of 2009, when lightning struck and damaged a water tank in the southern portion of Sublette County. Another lightning incident in Sublette County, which involved one injury and one death, occurred in Pinedale in 2003 when two hikers were struck by lightning twice.

Compared to the eastern portion of the State, Region 5 and the associated planning areas experience three times less cloud to ground lightning strikes. The most salient impacts associated with lightning events are the effects of loss of power or wildfire. Structural fire and injuries/fatalities are less likely, but both have been reported in the planning area. The probability of future occurrence for this event is highly likely, but the magnitude of these events is limited. Overall, lightning poses a high threat across the County due to the potential to affect power infrastructure, spark wildfires, and cause death and injury, and does not vary between the jurisdictions. See Chapter 4 of the base plan for more information on the previously recorded lightning events and associated damages.

6.3.13 Mine Subsidence

Sublette County has pockets of abandoned mine sites, but not nearly as many as Fremont County. Mines in the Region have been identified and there are mitigation projects designed to reduce the impacts from underground mining and subsidence, and to remove the threat they pose to the surrounding area. The unmitigated identified mines pose little to no threat to infrastructure in the surrounding area. Mine subsidence events occur occasionally, and the degree of risk and impact varies based on the characteristics of each mine.

6.3.14 Severe Winter Weather

Winter storms are a yearly feature of the Wyoming climate and may occur anywhere in the State. Blizzard conditions bring the triple threat of heavy snowfall, strong winds and low temperatures. Poor visibility and huge snowdrifts are major hazards caused by blowing snow. These storms disrupt work, make travel difficult or impossible, isolate communities, kill livestock by the hundreds or thousands and sometimes leave human fatalities in their wake.

- Based on the worst-case regional event that involved Sublette County (December 1983 cold snap) the dollar impacts could be more than \$334,000 (assuming an equal distribution of the total losses of \$7.9 million, in 2022 dollars, across the 23 counties involved), enough power lines could be toppled that emergency intervention could be required, significant property damage could occur, and the livestock industry could lose 15%-20% of its inventory

- The Sublette County HMPC reported a bus barn collapsed from a large snow load. Other impacts from winter storms included the Bondurant Arena being condemned in 2017 due to heavy snow related damage.

The overall significance of this hazard is high across the County and does not vary between the jurisdictions or the Region as a whole. Refer to Chapter 4 of the base plan for more information.

6.3.15 Tornado

Many documented tornadoes occurring in the counties in Region 5 are given low ratings on the Fujita Scale (F0s and F1s) simply because these tornadoes are often formed over open land and result in little or no damage. Since 1950, there have only been six recorded tornadoes in Sublette County, none of which have been rated higher than an F1. Of these events, there were no fatalities, no injuries, no crop damage, and property damages totaled \$21,000 of the \$648,530 reported damages in the planning area (around 4%).

All property is vulnerable during tornado events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Mobile homes are more vulnerable to the impacts of a tornado event compared to housing types due to methods of construction. Statewide, mobile homes represent about 13% of total housing compared to 6.1% Nationwide. Sublette County has a higher percentage of mobile homes as total housing compared to the national average, but lower than the Wyoming statewide average, with 9.2% of occupied housing units as mobile homes or other housing types.

Region 5 tornado events are very small in terms of magnitude, with limited associated impacts, and the low-level significance of this event does not vary across jurisdictions. See Chapter 4 of the base plan for more information on tornado events and impacts.

6.3.16 Wildfire

According to the 2022 Sublette County Community Wildfire Protection Plan (CWPP), there are four distinct vegetation communities in the County: sagebrush/grass steppe, lodgepole pine forest, spruce/fir forest, and aspen forest. Each of these vegetation communities respond differently to wildfire conditions and have differing levels of vulnerability. Of all the fires in Wyoming, over 50% involve wildland areas. Because of its semi-arid climate, available fuels, and rural character, Sublette County is vulnerable to catastrophic wildland fires.

Historically, most significant fires in Sublette County have occurred in the northern county, in and around the foothills and higher elevations of the Wind River Range. More recently there have been several fires affecting over 1,000 acres, and many smaller fires throughout the County.

According to the Federal Wildland Occurrence data, a total of 184 fires burned 171,167 acres. Many of these fires were relatively small, burning only a few acres, however a handful of large fires make up a significant portion of the total acres burned. One of the largest fires in Sublette County, the Fayette Fire, occurred in 1988 and burned 38,507 acres. The Fayette Fire remained the largest in Sublette County until the 2012 Fontenelle Fire. According to the National Geographic Area Coordination Centers, the Fontenelle Fire broke out in late June 2012 approximately 18 miles west of Big Piney and was not contained until mid-October of the same year, burning 64,215 acres throughout this time. The 2018 Roosevelt Fire, which burned almost twice as much area as the Fayette Fire, was another major occurrence in the county. The Roosevelt Fire ultimately burned more than 61,500 acres, destroyed 55 buildings, and caused three non-fatal injuries, as well as resulting in a federal Fire Management Assistance declaration. The fire had significant impacts on the Hoback Ranches Special Services District. The table below describes Sublette County wildfires that burned 1,000 or more acres between 1980 and 2021.

Table 13 Wildfires over 1,000 acres in Sublette County: 1980-2021

Name	Year	Acres Burned
Fontenelle	2012	64,215
Roosevelt	2018	61,522
Fayette	1988	38,507
New Fork	2008	15,089
Horse Creek	2007	8,590
Marten Creek	2018	6,491
Fayette	1996	4,500
Jim Creek WFU	2006	3,895
Mule Fire	2002	3,400
Divide	2002	2,620
Saltlick	2007	2,582
Broadie Dr	1999	2,500
Coal Creek	1997	1,700
Natural Bridge	1988	1,600
Cottonwood	1998	1,450
Battle Mountain	2006	1,370
Flatfish	1988	1,300
Lynda's	1985	1,146
Green	2013	1,065
Pole Creek	2007	1,044

Source: Federal Wildland Occurrence Data

Another method of estimating potential future impact is to determine the value of structures that are located within wildfire risk areas, or wildland fire building exposure values. Wildland fire building exposure value is the value of buildings that can be potentially damaged by wildland fire in an area. Building exposure values are based on county assessor data. The methodology utilized is like that used to model flood exposure described in the flood chapter. Based on GIS analysis performed, Sublette County has approximately \$607 million in improved property value potentially at risk to wildland fires, and there are an estimated 8,000 people living in the wildfire risk areas. Though it is not likely that the areas at risk will simultaneously face a completely destructive event, this figure provides the upper end of what could be affected. Future wildfires could damage crops and watersheds within the County and contribute to soil erosion and deposition problems.

The 2022 Sublette County Wildfire Protection Plan includes a detailed wildfire hazard assessment for the County. The majority of the County consists of land managed either federally or by the State of Wyoming; approximately 18.9% of the land in the County represents county lands, local jurisdictions, and private lands.

As part of the planning process, State, local and federal fire representatives from Sublette County reviewed the priority ranking of communities at risk within the County; see the County CWPP for specific community rankings and discussions of mitigation measures.

Figure 14 Sublette County CWPP Communities at Risk Hazard and Risk Ratings

HIGH Hazard	Values at Risk	RISK Rating
Temple Creek Residences	Residential structures	HIGH
Elkhart Park Recreation Area	USFS recreation infrastructure	HIGH
Sargent Subdivision	Residential structures	HIGH
Red Cliff Subdivision/Bible Camp	Residential/commercial structures	HIGH
Packer/Miner Subdivisions	Residential structures	HIGH
Black Butte	Residential structures	HIGH
Flying A Ranch	Residential/commercial structures	HIGH
Boulder Basin/Buffalo Head Springs Estate	Residential structures	HIGH
New Fork Residences/Boy Scout Camp	Residential/commercial structures	HIGH
Sylvan Bay Residences	Residential structures	HIGH
Rim Ranches/Summit Road	Residential structures	HIGH
Halfmoon Lodge/Private Structures	Residential/commercial structures	HIGH
Rolling Thunder	Residential structures	HIGH
MODERATE Hazard	Values at Risk	RISK Rating
Green River Lake Lodge	USFS structures/outfitter	MODERATE
Jim Bridger Estates	Residential structures	HIGH
Kendall Valley lodge	Residential/commercial structures	MODERATE
Hoback Ranches	Residential structures	MODERATE
Hecox/Fandek Subdivisions	Residential structures	HIGH
Middle Piney Summer Residences	Residential structures	MODERATE
Aspen Ridge Subdivision	Residential structures	HIGH
Green River Ranch Estates	Residential structures	MODERATE
Dutch Joe Guard Station	USFS administration structures	MODERATE
Boulder Lake Country Estates	Residential structures	MODERATE
Big Sandy Lodge	Commercial structures	HIGH
Moose Gypsum Subdivision	Residential structures	MODERATE
Fremont Lake Lodge/Private Structures	Residential/commercial structures	MODERATE
40 Rod Subdivision	Residential structures	HIGH
White Pine Ski Area	Residential/commercial structures	MODERATE
Sand Draw Industrial Area	Residential/commercial structures	MODERATE
Big Country/Barger Subdivisions	Residential structures	HIGH
LOW Hazard	Values at Risk	RISK Rating
Upper Hoback Corridor	Residential/commercial structures	MODERATE
Riverside Subdivision	Residential structures	MODERATE
Homestead Subdivision	Residential structures	MODERATE
N. Piney/Cottonwood Road Subdivisions	Residential structures	MODERATE
Muddy Creek/Brckett Minor Subdivisions	Residential structures	MODERATE
Exxon Mobile LaBarge Facility (B. Canyon)	Gas infrastructure	MODERATE
Mesa Road Gas Infrastructure/Private Homes	Gas infrastructure/residents	MODERATE
Emigration Ranches	Residential structures	MODERATE
Bondurant	Residential/commercial structures	HIGH
Yellow Point Well/Jonah Field Infrastructure	Gas infrastructure	MODERATE

Source: 2022 Sublette County CWPP

Wildfire is a high significance hazard in Sublette County, which is consistent with other study areas in the Region. However, as noted in the CWPP, risk is not consistent throughout the County and varies between jurisdictions.

- The wildfire risk in Pinedale is considered moderate/high due to the proximity of moderate/high fuel loading in trees located near the town's subdivisions. Pinedale is the largest population base of the County, and there is a higher risk for human caused fire ignitions.
- Wildfire hazard in Big Piney and Marbleton is currently low/moderate, due largely in part to the occurrence of the Fontenelle Fire in 2012. This event burned over 64,000 acres and removed most heavy wildland fuels. Ongoing mitigation efforts lead by the USFS have maintained this low level of risk.

Refer to Chapter 4 of the base plan for additional analysis of information outlined in the County CWPP.

Figure 15 Big Piney Wildfire Risk

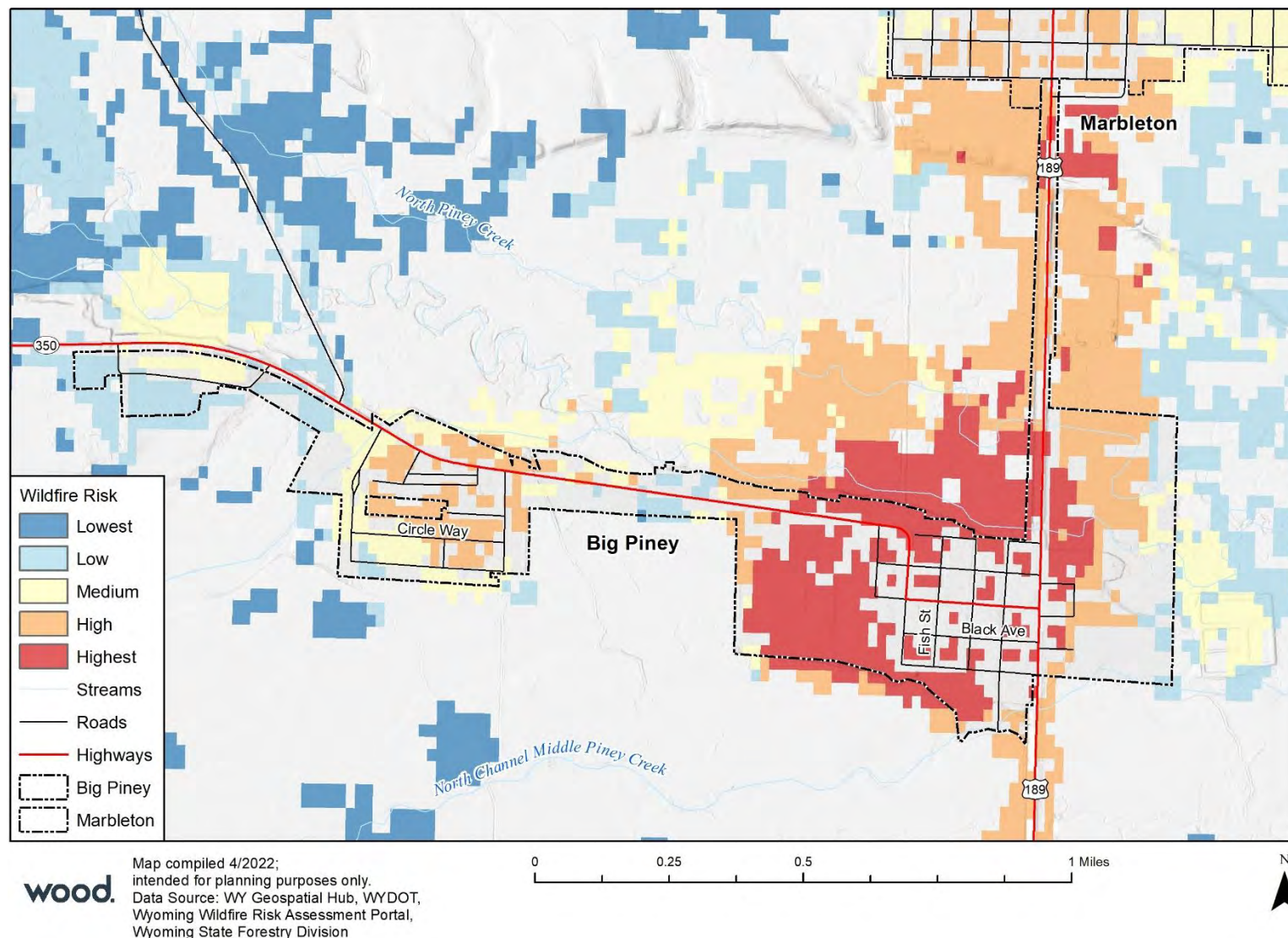


Figure 16 **Marbleton Wildfire Risk**

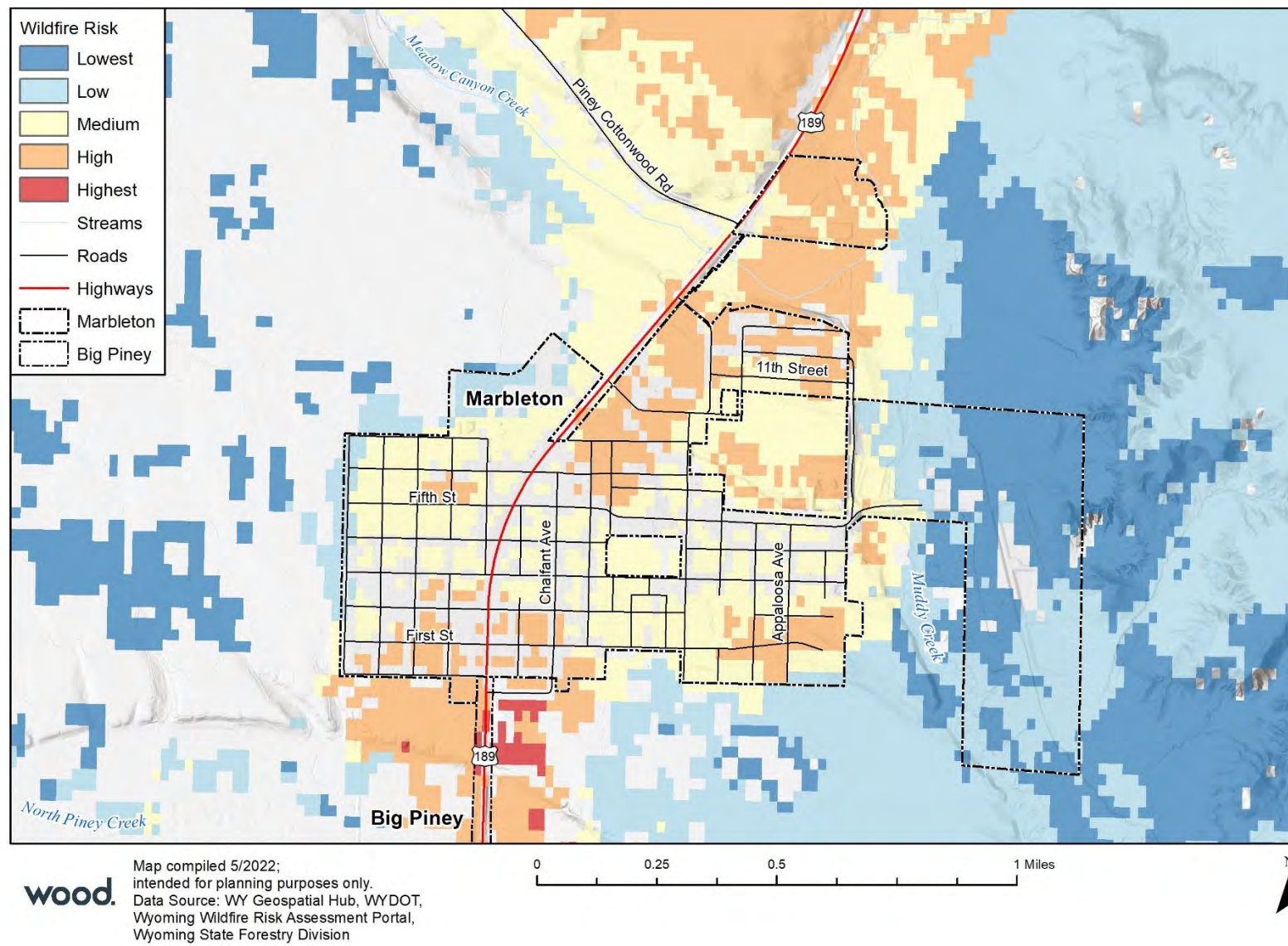
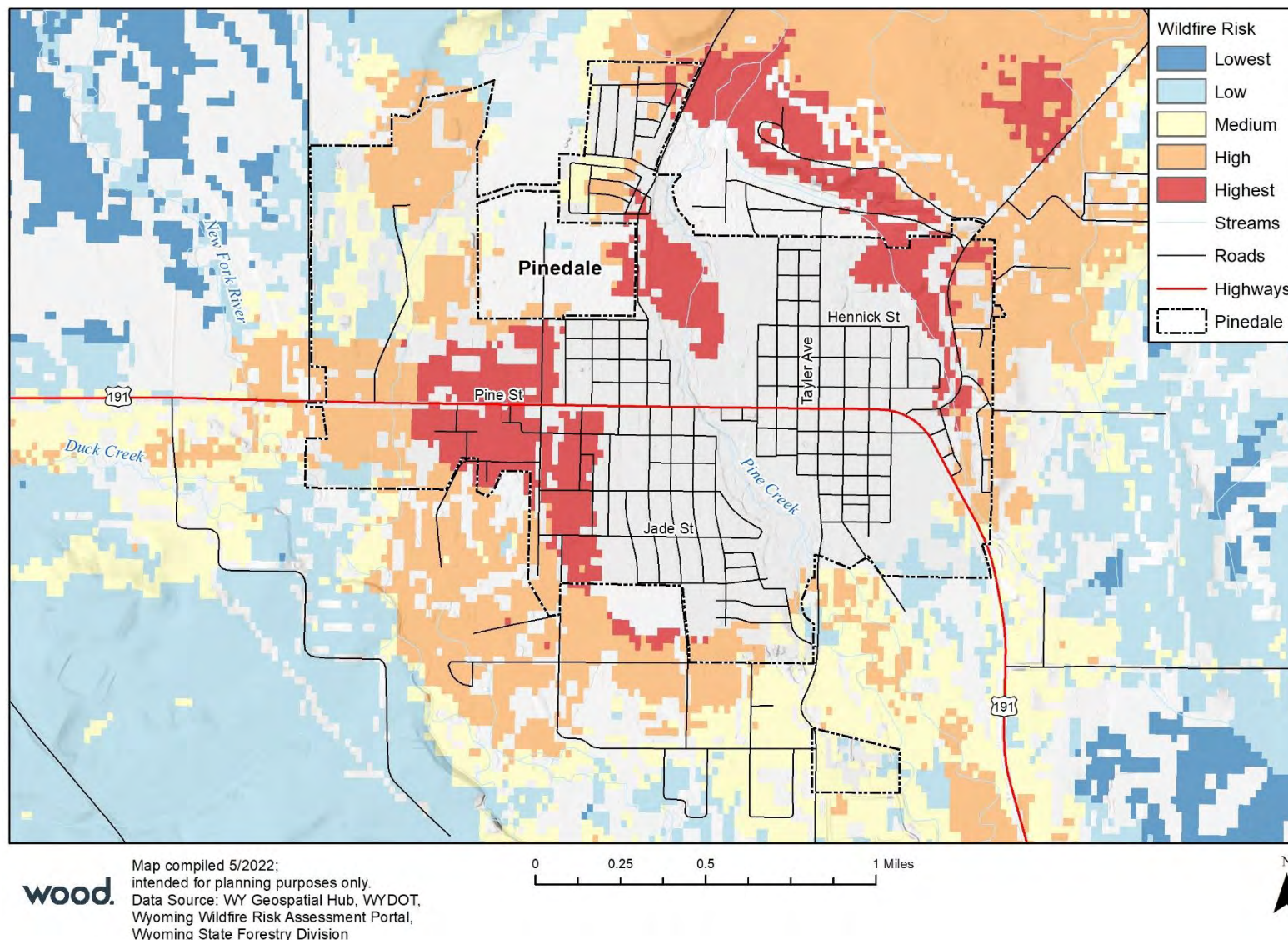


Figure 17 Pinedale Wildfire Risk



7 Mitigation Capabilities Assessment

As part of the Regional Plan development, the Region and participating jurisdictions developed a mitigation capability assessment. Capabilities are those plans, policies and procedures that are currently in place that contribute to reducing hazard losses. Combining the risk assessment with the mitigation capability assessment results in “net vulnerability” to disasters and more accurately focuses the goals, objectives, and proposed actions of this plan. The purpose of this effort was to identify policies and programs that were either in place or could be undertaken, if appropriate. Second, the HMPC conducted an inventory and review of existing policies, regulations, plans, projects, and programs to determine if they contribute to reducing hazard related losses.

Most communities, including Sublette County, have developed and implemented emergency preparedness plans for a variety of contingencies. Emergency preparedness plans are primarily reactive and focus on the community’s readiness to respond to natural and man-made disasters if and when they occur. Sublette County has implemented several emergency preparedness measures, such as stockpiling sandbags for future flood events, development of regional emergency response teams, and education and training for first responders.

7.1.1 Regulatory Mitigation Capabilities

Table 14 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Fremont County and each participating jurisdiction. Excerpts from applicable policies, regulations, plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Details on NFIP participation and flood map status are provided in Table 15.

Table 14 Sublette County NFIP Participation by Jurisdiction

Community	Date of Entry into Program	Current Effective Map Date
Sublette County	11/15/77	01/01/08(L)
Big Piney	01/24/75	(NSFHA)*
Marbleton	-	-
Pinedale	04/05/74	03/18/86

*No Special Flood Hazard Areas (SFHA) Currently Identified

Table 15 Summary of Sublette County Mitigation Capabilities

Planning & Regulatory Tools (ordinances, codes, plans)	County	Big Piney	Marbleton	Pinedale	Hoback Ranches	Changes Since 2017?
Comprehensive, Master, or General Plan	Yes 2015	No	No	No	No	
Capital Improvement Program or Plan (CIP)	Yes	No	No	No	No	

Planning & Regulatory Tools (ordinances, codes, plans)	County	Big Piney	Marbleton	Pinedale	Hoback Ranches	Changes Since 2017?
Floodplain Management Plan	Yes	No	No	No	No	
Stormwater Program / Plan / Ordinance	No	No	No	Yes	No	
Community Wildfire Protection Plan (CWPP)SCUF	Yes	No	No	No	No	Being Updated this year 2022
Erosion / Sediment Control Program	No	No	No	No	No	
Economic Development Plan	No	No	No	No	No	
Building Codes (Year)	No	No	No	Yes	No	
Site Plan Review Requirements	Yes	No	No	No	No	
Zoning Ordinance (Land Use)	Yes	No	No	No	No	
Subdivision Ordinance	Yes	No	No	No	No	
NFIP Participant	Yes Joined 7/13/94	Yes Joined 2/2/1984	No	No (Sanctioned)	NA	
Flood Insurance Study / Flood Insurance Rate Map / DFIRM	Yes	Yes	No	Yes	NA	
Floodplain Ordinance	Yes	Yes	No	No	NA	
Elevation Certificates for Floodplain Development	Yes	Yes	No	No	No	
Community Rating System (CRS) Participant	No	No	No	No	NA	
Open Space / Conservation Program	No	No	No	No	No	

Planning & Regulatory Tools (ordinances, codes, plans)	County	Big Piney	Marbleton	Pinedale	Hoback Ranches	Changes Since 2017?
Growth Management Ordinance	No	No	No	No	No	
Other Hazard Ordinance (steep slope, wildfire, snow loads, etc.)	Yes	No	No	No	No	
Other	USACE developing plans for additional water storage capacity in Middle Piney Lake, New Fork Lakes and Silver Lake	No	No	No	No	

7.1.2 Administrative and Technical Mitigation Capabilities

Table 16 Sublette County Administrative and Technical Mitigation Capabilities

Administrative/Technical Resources	County	Big Piney	Marbleton	Pinedale	Hoback Ranches	Changes Since 2017?
Planning Board / Commission	Yes	No	No	Yes	No	
Mitigation Planning Committee	Yes?	Yes	Yes	Yes	Yes	
Maintenance Programs (tree trimming, clearing drainage, etc.)	No	No	No	No	No	
Emergency Manager	Yes	No	No	No	No	
Building Official	No	No	No	No	No	
Floodplain Administrator	Yes?	Yes	No	No	No	
Community Planner	Yes	No	No	No	No	
Transportation Planner	No	No	No	No	No	
Civil Engineer	No	No	No	Yes	No	
GIS Capability	No	No	No	No	No	

Administrative/Technical Resources	County	Big Piney	Marbleton	Pinedale	Hoback Ranches	Changes Since 2017?
Warning Systems / Services (flood)	No	No	No	No	No	
Warning Systems / Services (other / multi-hazard)	No	No	No	No	No	
Grant Writing / Management	No	No	No	No	No	
Other:	Burn bans					

7.1.3 Financial Capabilities

Table 17 identifies the county and town financial tools or resources that the jurisdictions have access or are eligible to use and could potentially be used to help fund mitigation activities. The Hoback Ranches District, working with Sublette County as the sub applicant, applied and received HMGP-Post-Fire mitigation project funding to mitigate damage to roads from post-fire flood and erosion hazards following the 2018 Roosevelt Fire.

Table 17 Sublette County and Jurisdictions Financial Capabilities

Financial Resources	Accessible/Eligible to Use (Yes/No)	Has This Been Used for Mitigation in the Past?
Levy for Specific Purposes with Voter Approval	No	
Utilities Fees	No	
System Development / Impact Development Fee	No	
General Obligation Bonds to Incur Debt	Sometimes	
Special Tax Bonds to Incur Debt	No	
Open Space / Conservation Fund	No	
Stormwater Utility Fees	No	
Capital Improvement Project Funding	No	
Community Development Block Grants (CDBG)	No	
Other		

7.1.4 Education and Outreach Capabilities

Table 18 shows the mitigation education and outreach capabilities the County and jurisdictions have in place now. Additional information shared by the CPT is listed after the table.

Table 18 Jurisdictions Mitigation Education and Outreach Capabilities

Education & Outreach	Yes/No (And Briefly Describe)
Public Education /Outreach Program	Yes, Promotion of avalanche safety and education and awareness. Public education and awareness related to winter storm hazards. From both WYDOT and Tip Top Search and Rescue.
Local Citizen Groups That Communicate Hazard Risks	
Firewise	SCUF?
StormReady®	Yes, with the Assistance of the Warning coordination specialist from the National Oceanic and Atmospheric Administration (NOAA) Riverton Sublette is a Storm Ready County.
Other?	

7.1.5 Opportunities for Enhancement

Based on the capabilities assessment, Sublette County and the municipalities have several existing mechanisms in place that already help to mitigate hazards. There are also opportunities for the jurisdictions to expand or improve on their policies, programs and fiscal capabilities and further protect the community. Future improvements may include providing training for staff members related to hazards or hazard mitigation grant funding in partnership with the County and WOHS. Additional training opportunities will help to inform County and municipal staff members on how best to integrate hazard information and mitigation projects into their departments. Continuing to train staff on mitigation and the hazards that pose a risk to the County will lead to more informed staff members who can better communicate this information to the public.

Other opportunities include improved cross-jurisdictional communication on evacuation and awareness to mitigate life safety impacts during dam incidents, floods, or wildfires including the development of brochures and using existing communication capabilities through social media or other media. Other specific opportunities for improvement include:

- Consider adopting a Wildland Urban Interface Code (see recommendation in 2022 CWPP)

8 Mitigation Strategy

This section describes the mitigation strategy and mitigation action plan for Sublette County. See Chapter 5 of the base plan for more details on the collaborative process used to develop and update the mitigation strategy.

8.1 Mitigation Goals

Sublette County has identified goals to guide the development of the Hazard Mitigation Strategy. These goals were developed after receiving input from the LEPC during the 2017 planning process and updated in 2022 by the HMPC. The potential hazards, risks and vulnerabilities were also considered in the development of the goals.

- Goal 1: Protect Life and Property. Implement activities that will protect lives and reduce property loss which may occur as a result of natural or man-made hazards
 - Improve emergency communications
 - Develop plans for dealing with health-related emergencies
 - Minimize flood risk by developing early warning systems
 - Minimize wildland fire risk by developing area evacuation plans
 - Provide additional sheltering facilities and supplies
 - Reduce economic losses including business impacts
- Goal 2: Increase Public Awareness. Provide resources for outreach and education programs to increase public awareness of risks associated with natural and man-made hazards.
 - Improve public education and awareness programs
 - Implement employee emergency response training
- Goal 3: Increase Knowledge. Gather information necessary to assess and develop plans to avoid and respond to risks and events associated with natural and man-made hazards.
 - Educate special needs and at-risk residents about hazards and develop evacuation and emergency response plans for them
 - Investigate earthquake damage mitigation strategies
 - Improve public knowledge of county notification systems

8.2 Mitigation Actions

This section provides updates on the actions identified in the 2017 Sublette County Multi- Hazard Mitigation Plan and new actions identified during the 2022 Regional Plan development.

8.2.1 Progress on 2017 Actions

During the 2022 planning process the Sublette County Planning Team reviewed all the mitigation actions from the 2017 plan. Of their 29 mitigation actions from 2017, all 29 of the actions are continuing, and several are implemented annually, demonstrating ongoing progress and building the community's resiliency to disasters.

8.2.2 Identification and Implementation of Mitigation Measures

Sublette County has identified several potential hazard mitigation projects that would benefit the County and reduce potential risks and vulnerabilities. These projects were originally developed with input from the LEPC and from the Public Meetings. Worksheets and discussion spurred the evaluation of the previously identified actions to assess progress on implementation. Each item was assessed and determined whether the action was completed, ongoing/continued, or deleted. Reasons that some actions have not been completed include low priority, lack of funding, or lack of administrative resources. The HMPC's evaluation of action items and updated goals also lead to the addition of new strategies. The action plans were also shared amongst the Regional Plan participants to showcase progress and stimulate ideas amongst the respective planning committees in each county. Table 19 lists the hazard, the project, the priority, who the responsible agency is, the goal the project supports, and a possible funding source. The tables are separated into ongoing mitigation strategies from 2017, new mitigation strategies identified in 2022, and completed and deleted strategies from 2017. Mitigation actions for municipalities that did not participate in the 2022 plan update are considered "continuing" should they decided to participate in future updates.

Table 19 Sublette County Mitigation Action Plan

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
S - 1	Goals: 1, 2, 3 Lifelines: ENG	Establish and maintain a dam safety program to include: evaluations and inspections, dam modeling for potential earthquake damage, monitoring of rain and snowmelt, evacuation plans, and awareness of sabotage and terrorist activity.	Dam Failure	Sublette County Areas of concern below dams. Big Piney	"Dam Owners, Wyoming State Engineers, U.S. Army Corps of Engineers, Emergency Management	Annual Implementation	\$75,000	Low	Continue – In Progress.
S - 2	Goals: 2 Lifelines: NA	Public awareness programs on management of natural resources, adopting farming practices less vulnerable to drought, and crop insurance.	Drought	Sublette County	Sublette County Water District/ Irrigation District Conservation District. Landowners	Annual Implementation	\$5,000	Medium	Continue – In Progress.
S - 3	Goals: 1 Lifelines: SS, HM	Evaluation of retrofitting of clinics and public facilities.	Earthquake	Sublette County	Emergency Mgt. Entire County, Marbleton, Pinedale, Big Piney	2024	\$20,000 for evaluation	Medium	Continue – In Progress. Marbleton to Improve HVAC system, retrofit underway w/ hospital construction.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
S - 4	Goals: 2 Lifelines: NA	Early warning and monitoring systems for Fremont Lake outflows.	Flood	Sublette County	Emergency Mgt., County Commission, USGS, County, Pinedale	2024	Unknown	Low	Continue – In Progress.
S - 5	Goals: 1 Lifelines: NA	Expanded Participation in NFIP.	Flood	Pinedale, Marbleton	Pinedale and Marbleton Administration and town Council, Pinedale, Marbleton	Annual Implementation	Existing staff time and resources	Low	Continue – In Progress.
S - 6	Goals: 1 Lifelines: NA	Continued compliance with NFIP to mitigate risk to new development.	Flood	Sublette County	Sublette County Big Piney	Annual Implementation	Existing staff time and resources	Low	Continue – In Progress.
S - 7	Goals: 1 Lifelines: Hazmat	Training and additional personnel. 2 personnel have been trained and four additional have been added but more training will be needed to maintain and enhance capabilities for hazardous materials response.	Hazmat	Sublette County	Sublette County Unified Fire	Annual Implementation	\$60,000	Medium	Continue – In Progress.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
S - 8	Goals: 1 Lifelines: Hazmat	Enhanced training and exercise program.	Hazmat	Sublette County	Sublette County Unified Fire	Annual Implementation	\$6,000	Medium	Continue – In Progress.
S - 9	Goals: 2 Lifelines: NA	Public awareness program on landslide hazards. Landslides and rockfall can affect highway infrastructure and USFS roads. The County will utilize social media and other warning systems when landslides affect or close roads. This would be done in coordination with WYDOT and USFS	Landslide	Sublette County	Emergency Management, WYDOT, USFS	Annual Implementation	Existing staff time and resources	Medium	Continue - Not Started.
S - 10	Goals: 2 Lifelines: NA	Public awareness programs on lightning hazards.	Lightning	Sublette County	Emergency Management County and municipalities	Annual Implementation	Existing staff time and resources	Medium	Continue – In Progress. Marbleton noted information could be shared with water bills.
S - 11	Goals: 2 Lifelines: NA	Enhanced reverse 911 system to include phone system phone numbers and the integrate with GIS information	All Hazards	Sublette County	Emergency Management	2023-2025	\$10K Annual Subscription \$5K/yr.	High	Continue - In Progress.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
S - 12	Goals: 2 Lifelines: NA	Bilingual emergency preparedness information including printed, radio and social media	All Hazards	Sublette County	Emergency Management	2023-2025	\$15,000	High	Continue - Not Started.
S - 13	Goals: 1 Lifelines: FWS	Additional emergency shelter facilities and supplies.	All Hazards	Sublette County	Emergency Mgt. ARC County, Marbleton, Pinedale, Big Piney	Annual Implementation	\$25,000	Medium	Continue – In Progress.
S - 14	Goals: 1 Lifelines: NA	Senior Center evacuation plan.	All Hazards	Sublette County	Emergency Mgmt., Pinedale, Marbleton	2024	\$5,000	High	Continue – In Progress.
S - 15	Goals: 2, 3 Lifelines: NA	Development review	All Hazards	Sublette County	County Planning	Annual Implementation	Existing staff time and resources	High	Continue - In Progress.
S - 16	Goals: 2 Lifelines: NA	Monitor snowpack for avalanche, drought and flood potential	All Hazards	Sublette County	Bridger-Teton Avalanche Center Public land agencies NRCS	Annual Implementation	Unknown	Low	Continue - In Progress.
S - 17	Goals: 1, 2 Lifelines: NA	Public awareness programs. Tip Top SAR does avalanche beacon training annually. Any reports of	Avalanche	Sublette County	Emergency Management Tip Top Search and	Annual Implementation	\$2,500 \$1,000	Low	Continue - In Progress.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		high avalanche conditions are posted on social media.			Rescue; Bridger-Teton Avalanche Center				
S - 18	Goals: 1, 2, 3 Lifelines: NA	Provide Public Information on Wildfire Risk Mitigation	Wildfire	Sublette County	Sublette County Unified Fire Emergency Management	Annual Implementation	\$12,000	High	Continue - In Progress.
S - 19	Goals: 2, 3 Lifelines: NA	Develop individual community evacuation plans	Wildfire	Sublette County	Sublette County Unified Fire Emergency Mgt. and SAR	Annual Implementation	\$60,000	High	Continue - In Progress.
S - 20	Goals: 1 Lifelines: Comm	Increased public awareness through public service announcements and through media.	Winter Storm	Marbleton	County Emergency Management and Municipalities	Annual Implementation	\$10,000	Medium	Continue – In Progress. Marbleton – Utilize Facebook and water bills.
S - 21	Goals: 1, 3 Lifelines: FWS, ENG	Marbleton SCADA / Water system protection from lightning.	Lightning	Marbleton	Town of Marbleton	2024	\$20,000	High	Continue – In Progress. Marbleton – Applied for funds for upgrades.
S - 22	Goals: 1, 3	Pinedale SCADA / Water system protection from	Lightning	Pinedale	Town of Pinedale	2024	\$20,000	High	Continue – In Progress. Pinedale has invested in a lot

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
	Lifelines: FWS, ENG	lightning, cyber incidents and drought.							of SCADA upgrades. Cyber security is still a concern. Looking at drought resiliency and possible addition of storage facility.
S - 23	Goals: 2, 3 Lifelines: NA	Install additional stream gages and enhance flood monitoring. This project would entail coordinating with the USGS to install more gauges	Flood	Sublette County	County Emergency Management, USGS	2023-2024	Variable depending on project	High	Continue - Not Started.
S - 24	Goals: 3 Lifelines: NA	Implement the recommendations of the 2010 Pinedale Drainage Study and Five-Year Plan.	Flood	Pinedale	Town of Pinedale administration and Public Works	2024	Variable depending on project	Medium	Continue – In Progress. Grant application American Rescue Plan Act (ARPA) funding in process.
S - 25	Goals: 1 Lifelines: NA	Develop a snow removal plan to mitigate drainage problems and Strategic Stockpiling / Aquifer Recharge.	Winter Storm, Flood, Drought	Marbleton	Town of Marbleton	Annual Implementation	\$20,000	Medium	Continue – In Progress. Need coordination with WYDOT.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
S - 26	Goal: 1 Lifelines: Trans	Highway corridor multi-hazard mitigation. Landslide impacts Hwy 191/189 Snake River Canyon 89 in adjacent Teton County WYDOT can impact flow of goods and services into the County. This project would entail continued coordination on mitigation projects that may be planned and implemented by WYDOT and Teton County	Landslide	Sublette County	Emergency Management, WYDOT, Teton County	Annual Implementation	Existing staff time and resources	Medium	Continue - Not Started.
S - 27	Goals: 1 Lifelines: NA	Raise fire hydrants so that access is free of snow	Winter Storm	Marbleton	Town of Marbleton	2023-2028	\$15,000	Medium	Continue – In Progress. Seeking funds to complete 10 hydrants per year.
S - 28	Goals: 1 Lifelines: FWS, HM	Mitigate impacts of snow loading on buildings through recommendations based on elevation zones within the County. The County is working on a document that will have snow load recommendations for buildings based on	Winter Storm	Sublette County	County Planning and Zoning	Annual Implementation	Existing staff time and resources	Low	Continue - Not Started.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		elevation zones in the County. This could help mitigate collapses and structural damage and possibly injury and death							
S - 29	Goals: 1, 3 Lifelines: Trans	Safety, engineering, and possible improvement study for Rim Road east of Elk Drive to the Eastern HRSID Border. Steep unprotected inclines, drainage issues, possible placement of guardrails, faulty retaining walls; at shoulder of road, dead tree snags that will fall across Rim Road. Landslides in the burn scar from 2018 Roosevelt Fire.	Landslides/ Debris Flow, Flood	Hoback Ranches Special Improvement District	HRSID, Sublette County	2023-2028	\$100,000	High	New in 2022.
S - 30	Goals: 1, 2 Lifelines: SS	Implement recommendations of County CWPP to mitigate wildfire impacts. The Sublette county CWPP contains recommendations for fuel treatment projects, ignition resistant construction, emergency	Wildfire	Sublette County	County Unified Fire	2023-2025	Variable depending on project	High	Continue - Not Started.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		access/egress and dry hydrant and water supply enhancement projects. This action formally links the two plans							
S - 31	Goals: 1, 3 Lifelines: Trans, FWS	“Lee Ditch” Landslide Risk Assessment and Mitigation. The Pine Creek Canal No. 1, Extension of the Lee Ditch (AKA Lee Ditch) is an irrigation ditch that runs along a hillside through parts of the County and the Town of Pinedale. The hillside below the ditch adjacent to Highway 191 near the southeastern Pinedale town limits is experiencing hillside sloughing. The ditch is a risk to being compromised by the landslide, which would also impact Highway 191. Damage to the ditch would compromise water delivery to irrigators and impact agriculture. Local engineering companies have been monitoring the	Landslide	Sublette County, Pinedale	County Road and Bridge, County OEM, Planning and Zoning, Pinedale Public Works, Pine Creek Ditch Association Inc,(Pine Creek Canal No. 1, Extension of the Lee), WY DOT, private land owners	2023-2028	\$250,000-\$500,000, FEMA Grants	High	New in 2022.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		issue in 2022, along with seepage from irrigation upstream of the ditch. There have been historical failures including one in 1982 that shut down irrigation for 2 months. This project would entail a geotechnical investigation to understand the slope failure risk and potential mitigation measures. Several entities would be involved in the mitigation solution.							
S - 32	Goals: 1 Lifelines: Trans	Sublette County highway 23-134 Big Piney Caplet Improvements. While the roadway is continually maintained, it is coming at an augmented expense continually growing from year to year. Most of the issues are due to rain fall, and moisture. Whether it be a small squall, or a torrential down pour, after each rain portions of the	Landslide/ Debris Flow, Flood	Sublette County	County Road and Bridge	>5 Years	?	Medium	New in 2022.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		roadway always requires additional maintenance at an extended expense. Some of the challenges that have been experienced with the road are as follows: severe undermining, washouts, silting and blockage of culverts and cattle guards, erosion of roadway shoulders.							
S - 33	Goals: 3 Lifelines: FWS	Drought Resilience Planning tool. Town Municipal water supply is stored and conveyed from Fremont Lake. The TOP possess both direct flow and storage rights. The impacts of more frequent drought cycles in the Upper Green River Basin watershed threaten lower potential water levels. Imminent Curtailment of the Green River/ Colorado River will greatly affect how Pinedale is able to use their	Drought	Pinedale	Town of Pinedale, USFS Pinedale District	2023-2028	\$250,000-\$300,000	High	New in 2022.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		existing post 1922 Water Rights. Thus lowering the lake level and Decreasing Head pressure that powers the greater Pinedale water distribution system.							
S - 34	Goals: 1, 3 Lifelines: NA	Updated Flood Hazard Planning Map. The current NFIP mapping was completed in 1986, with development and work in Pine Creek, this has changed hydraulic conditions of the Creek. Curtailment would now greatly increase flows and Erosion in the Pine creek Drainage that runs through Pinedale. Accurate Mapping would help Pinedale to join the NFIP and provide access to proper flood insurance. Enabling Pinedale planning Department to make accurate flood planning decisions. This would also	Flood	Pinedale	Town of Pinedale, FEMA, NFIP	2023-2028	\$200,000	Medium	New in 2022.

ID	Goal(s) and Lifelines	Action Description	Hazard(s) Mitigated	Jurisdiction	Lead Agency and Partners	Timeline	Cost Estimate and Potential Funding	Priority	Status/ Implementation Notes
		provide access for residents to the NFIP insurance program.							
S - 35	Goals: 1 Lifelines: ENG	Backup Auxiliary Power for water TX facility. Water Tx is dependent on power for water treatment. Backup power is limited to a propane generator system. This source of power only has a 48 hour running time before water treatment ceases. This might include a natural gas powered generator. NG being run to the tx facility. Converting current Aux Power from propane to NG. Transfer switching to add another auxiliary port for an external generator.	All Hazards	Pinedale	Town of Pinedale	2024	\$100,000	Medium	New in 2022.

9 Implementation

Moving forward, the County HMPC will use the mitigation action table in the previous section to track progress on implementation of each project. As illustrated in the county's Mitigation Action Plan in Table 19, significant progress has been made since the plan was originally developed in 2007-8, with work begun on many actions. Implementation of the plan overall is discussed in Chapter 8 in the Regional Plan.

9.1 Incorporation into Existing Planning Mechanisms

To determine if this plan is consistent with goals identified in other community plans, the members of the Sublette County Office of Homeland Security along with the Hazard Mitigation Planning Team and LEPC will meet with other agencies who have plans that address such issues as economic development, subdivision resolutions/ordinances, capital improvement, building permits, growth management, sustainability, environmental preservation, historic preservation, redevelopment, health and/or safety, recreation, or transportation. The process will provide an opportunity to integrate and/or correlate plans for the purpose of:

- Determining if the mitigation plan is compatible with goals stated in other plans.
- Identifying mitigation initiatives or proposed projects which serve multiple objectives for the communities and could be included in multiple plans.
- Identifying needs for revision or updating to the mitigation plan, or other plans, to provide a more comprehensive approach to hazard mitigation (including addition of new mitigation measures).

During the 2022 planning process the HMPC discussed the importance of coordinating the mitigation plan with other planning processes, and vice versa. To date the plan has not been integrated with other planning efforts (2022 THIRA?). The group discussed opportunities to cross reference the hazard mitigation plan in other upcoming planning efforts. As described in the capability assessment, the County and municipalities already implement policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. Where applicable, these existing mechanisms could include:

- County or community comprehensive or land use plans
- County or community development codes
- County or community Emergency Operations Plans
- THIRA
- CWPP
- Capital improvement plans and budgets
- Recovery planning efforts
- Watershed planning efforts
- Wildfire planning efforts on adjacent public lands
- Master planning efforts including Pinedale Drainage Study and Five-Year Plan
- WYDOT landslide mitigation efforts
- Office of State Lands and Investments Drinking Water or Clean Water Intended Use Plan
- Other plans, regulations, and practices with a mitigation aspect

9.2 Funding Sources

Funding for the proposed mitigation projects may come from a variety of sources. Below is a list of funding possibilities. This list is not tied directly to each proposed project; however, these programs could work for specific projects or multiple projects.

Local Government

- General revenues in the form of matches.
- County and Municipal Utility Authorities.

State of Wyoming

- Community Development Block Grant Program.
- Federal Mineral Royalty Capital Construction Account.
- Office of State Lands and Investments grants and loans.
- Wyoming Water Development Program.
- State and Community Highway Safety, Department of Transportation.
- Transportation Enhancement Activities Local (TEAL).
- Wildfire Mitigation Grant (State Forestry Division).

Federal Government Agency Programs

- Federal Emergency Management Agency Hazard Mitigation Assistance Grants including:
 - Building Resilient Infrastructure and Communities (BRIC).
 - Pre-Disaster Mitigation (PDM).
 - Flood Mitigation Assistance Program (FMA).
 - Hazard Mitigation Grant Program (HMGP).
 - Notice of funding availability typically released in June with applications due in October/November of each year.
 - HMGP is dependent on federally declared disasters within the State and funding amount is based on a percentage of disaster relief costs.
- USDA Environmental Quality Incentive Program
- USDA Conservation Reserve and Conservation Reserve Enhancement Program
- USDA Small Watersheds (NRCS)

There are many more potential funding opportunities available to the municipalities and county. Funding research will be done during the scoping process for each project. New funding mechanisms may be present that were not before. Funding cycles should be monitored so there is adequate time to prepare grant applications.

9.2.1 Monitoring, Evaluating and Updating the Plan

Sublette County will follow the procedures to review and update this plan in accordance with Region 5 as outlined in Chapter 6 of the Regional Plan. Sublette County realizes it is important to review and update this plan regularly, and to continue to involve the public. This is especially important as the County receives additional information which may change the risk analysis and resulting mitigation projects list.

Appendix A: Planning Process

Wyoming Region 5
Hazard Mitigation Plan

2023-2028

Project Backgrounder



Regional Hazard Mitigation Plan Update

Wyoming all-hazards emergency management Region 5 consists of Fremont and Sublette counties in addition to the Northern Arapahoe and Eastern Shoshone tribes of the Wind River Reservation. The Region is updating the 2017 Regional Hazard Mitigation Plan in collaboration with local municipalities, special districts, and other stakeholders. This plan develops community mitigation strategies, to work towards reducing the risks posed by hazards. The plan must be updated and approved by FEMA every five years to keep it current and to maintain eligibility for mitigation grant assistance.

The term "Hazard Mitigation" describes actions that can help reduce or eliminate long-term risks caused by hazards, such as floods, wildfires, tornadoes, and earthquakes. Hazard mitigation is best accomplished when based on a comprehensive, long-term plan developed before a disaster strikes.

As the costs of disaster impacts continue to rise, governments and citizens must find ways to reduce hazard risks to our communities. Oftentimes after disasters, repairs and reconstruction are often completed in such a way as to simply restore damaged property to pre-disaster conditions. These efforts may "get things back to normal," but the replication of pre-disaster conditions often results in a repetitive cycle of damage, reconstruction, and repeated damage.

Hazard mitigation breaks this repetitive cycle by producing less vulnerable conditions through pre- and post- disaster repairs and reconstruction. The implementation of such hazard mitigation actions now by state, tribal and local governments means building stronger, safer, and smarter communities that will be able to reduce future injuries and damages.

Project Benefits

Mitigation is an investment in a community's future safety and sustainability. Recent cost-benefit studies have proven mitigation to be cost effective for communities, with mitigation projects returning \$6 for every \$1 spent. Mitigation planning helps communities identify and prioritize actions that can be taken before a disaster or hazard event, to reduce impacts when they occur.

Hazard mitigation planning helps residents, business owners, elected officials, tribes and municipal departments think through how to plan, design, build, and establish partnerships for risk reduction. Consider the critical importance of mitigation to:

- Protect public safety and prevent loss of life and injury.
- Reduce harm to existing and future development.
- Maintain community continuity and strengthen the social connections that are essential for recovery.
- Prevent damage to your community's unique economic, cultural, and environmental assets.
- Minimize operational downtime and accelerate recovery of government and business after disasters.
- Reduce the costs of disaster response and recovery and the exposure to risk for first responders.
- Help accomplish other community objectives, such as capital improvements, infrastructure protection, open space preservation, and economic resiliency.



Additionally, participating jurisdictions will benefit from this project by:

- Ensuring eligibility for all sources of hazard mitigation funds made available through FEMA.
- Increasing public awareness and understanding of vulnerabilities as well as support for specific actions to reduce losses from future disasters.
- Ensuring community policies, programs, and goals are compatible with reducing vulnerability to all hazards and identifying those that are incompatible.
- Building partnerships with diverse stakeholders, increasing opportunities to leverage data and resources in reducing workloads, as well as achieving shared community objectives.
- Expanding the understanding of potential risk reduction measures to include: local plans and regulations; structure and infrastructure projects; natural systems protection; education and awareness programs; and other tools.
- Informing the development, prioritization, and implementation of mitigation projects. Benefits accrue over the life of these projects as losses are avoided from each subsequent hazard event.

How to Get Involved:

Residents, organizations, and businesses are encouraged to contribute to the planning process. Over the next few months, the counties, their municipalities, and the tribes will reach out to the public for input on hazards and their mitigation through a short, online survey. Public input is important to developing an actionable plan that reflects community priorities, and there will be additional opportunity for public input before the updated plan is finalized later in 2022.



For more information, please contact your county's or tribe's Homeland Security Coordinator:

<https://hls.wyo.gov/contacts/county-contacts>



SAMPLE Email Text for Counties

RE: Region 5 Hazard Mitigation Plan Update 2022 – Planning Team invitation and kickoff meeting

You are invited to the first of three planning meetings to update the Region 5 Hazard Mitigation Plan. The plan was developed in 2017 in accordance with the Disaster Mitigation Act of 2000, which requires all local governments to develop a plan to assess their risks to hazards and identify actions that can be taken in advance to reduce future losses. Hazard mitigation plans are to be updated every five years in order to maintain eligibility for FEMA Hazard Mitigation Assistance grants. The Region 5 Hazard Mitigation Plan includes Sublette and Fremont counties and the Northern Arapaho and Eastern Shoshone tribes of the Wind River Reservation. Each county and the reservation have an annex as part of the plan with specifics to each jurisdiction.

**Regional Multi-jurisdictional Hazard Mitigation Plan Update
Kickoff Meeting/Webinar
Date: February 10, 2022
Time: 1:30-3:00
Remote Webinar link will be sent by Outlook.**

The hazard mitigation planning process is heavily dependent on the participation of representatives from local government agencies and departments, the public, and other stakeholder groups. County Planning Teams (CPT) are being re-vitalized to support this project and will include representatives from the County and incorporated cities and towns. Other interested stakeholders, including local and regional agencies involved in hazard mitigation activities or agencies that regulate development, are also invited. This includes special districts, private-non-profit entities, business partners, academic institutions, and other local, state, and federal agencies in the Region.

At the kickoff meeting, we will discuss the benefits of updating the hazard mitigation plan, the project schedule, and revisit the list of hazards that affect the Region, such as wildfires, floods, winter storms, landslides, and more.

Appropriate persons to be a part of the planning committee include but are not limited to: county and municipal planners, public works directors, floodplain managers, economic development directors, GIS staff, first responders, local government administration, elected officials, business partners, private-non-profit representatives, and school district representatives. Each municipality must have at least one representative at the meetings to meet participation requirements. We request your assistance in forwarding this invitation to others in your jurisdiction, as needed. There will be 3 total primary planning meetings held during the update process over the next 6 months, with submittal of the updated plan for State and FEMA review late in 2022.

As the County Emergency Manager, I will be taking the lead in coordinating the update of this plan. The Wyoming Office of Homeland Security has hired a consultant, Wood Environment & Infrastructure Solutions, Inc., to manage the planning project. Wood will facilitate the planning process, collect the necessary data, and perform other technical services, including updating the risk assessment and plan document. However, to successfully complete this project and ensure your organization is eligible for FEMA hazard mitigation assistance funding, we need your participation and input.

A Microsoft Outlook meeting invitation/calendar item will be sent out soon; please confirm your attendance or provide contact information for your designated alternate. Looking forward to your input and participation during the process.

From: Clinton Glick <cglick@esthealth.org>

Sent: Wednesday, February 9, 2022 4:10 PM

To: David Meyers <david@esthealth.org>; Morning Rae Ferris <mrferis@esthealth.org>; Brislawn, Jeff P <jeff.brislawn@woodplc.com>; Arlayna Miller <amiller@esthealth.org>; Erin Munnell <emunnell@esthealth.org>; Irene Iujan <ilujan@esthealth.org>; Kathleen Hill <khill@esthealth.org>; Nikki Ferris <nferris@easternshoshone.org>; Stormi Lebeau <slebeau@esthealth.org>; Vickie Engavo <vickie@esthealth.org>; Amanda Glanz <wsteele@esthealth.org>

Subject: Tribes Region 5 update kickoff Invite 02-09-22

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hello All

Here is an invite for the Region 5 kickoff meeting to be held on February 17th 2022 @ 1:30 p.m. to 3:00 p.m...

Clint

--

Clinton W. Glick

Eastern Shoshone Tribal Health - Public Health Emergency Response Coordinator

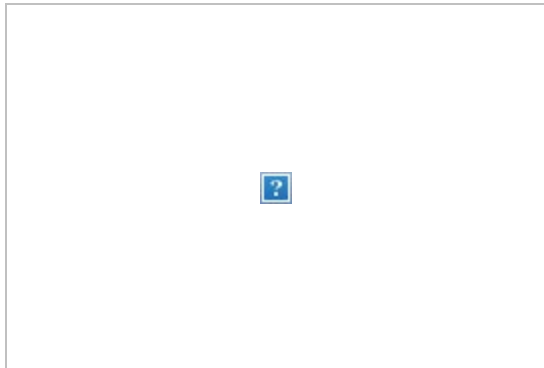
PO Box 250

Fort Washakie, WY 82514

Cell Phone (307) 349-9091

Work (307) 332-6805

Fax 307-332-0458



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Wyoming Region 5 Hazard Mitigation Plan Update Kick-Off Meeting Summary February 17, 2022, 1:30 pm-3:00 pm MDT Virtual Webinar via Zoom

Introductions and Opening Remarks

Wyoming Region 5 (Fremont and Sublette counties, Wind River Reservation) will be updating its Regional Hazard Mitigation Plan in 2022. A kickoff meeting for this planning process was held on February 17, 2022, facilitated by Wood Environment & Infrastructure Solutions, Inc. (Wood), the consulting firm hired by the Wyoming Office of Homeland Security to facilitate the planning process and develop the updated Region 5 plan. A total of 28 people attended, primarily representing county, tribal and municipal governments as well as various stakeholders including representatives from Wyoming Office of Homeland Security (WOHS). Jeff Brislawn, Project Manager, (Wood) began the meeting by going over the meeting agenda. Each Emergency Management Coordinator from the 2 counties and the 2 tribes associated with the Wind River Reservation, as well as the State Hazard Mitigation Officer for Wyoming, introduced themselves to the group and thanked everyone for their participation.

The key discussion is summarized below; additional details can be found in the meeting PowerPoint presentation. An interactive polling tool called Slido was used to gather feedback from the group throughout the meeting. After an icebreaker test question, the group was polled 'Did you participate in the 2017 plan?' 64% responded Yes and 36% No.

A recording of the meeting can be referenced at:

[Region 5 HMP Kickoff.mp4 - Google Drive](#)

Mitigation, Mitigation Planning, and Disaster Mitigation Act Requirements Overview

Mitigation is any sustained action taken to reduce or eliminate long-term risk to human life and property from natural or human-caused hazards. Mitigation Planning guides mitigation activities in a coordinated and economic manner to make Wyoming more disaster resilient. The U.S. Disaster Mitigation Act of 2000 requires state and local governments to adopt a hazard mitigation plan, updated every five years, to maintain eligibility for FEMA mitigation assistance grants.

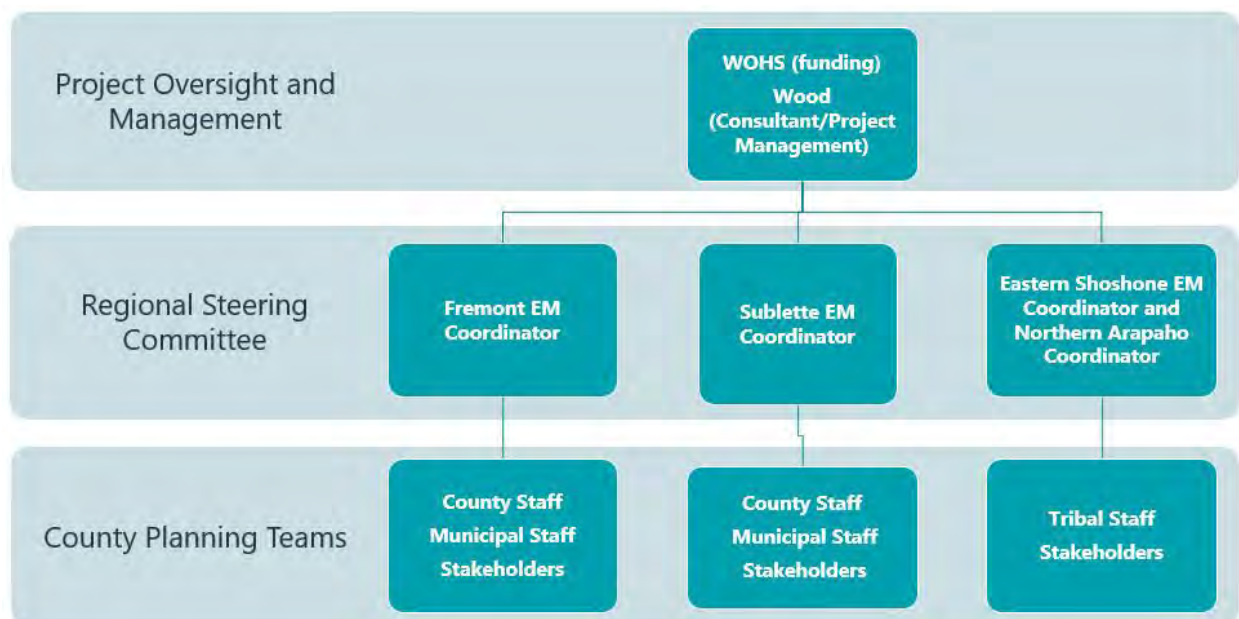
Jeff (Wood) explained the Disaster Mitigation Act of 2000 which requires having an updated plan in place to ensure each local or tribal government jurisdiction in Region 5 is eligible for pre- and post-disaster hazard mitigation grant funds. There are trends resulting in increased costs for disaster response and recovery related to population growth and the increase in the types of events we experience as a community. The COVID-19 Pandemic is a good example of a circumstance that can cause a regional disruption in the community and to the economy. Jeff explained we need these plans for several reasons because they reduce future recovery costs, we can plan around predictive events, and they guide mitigation activities in a coordinated manner.

Jeff explained Federal Emergency Management Agency (FEMA) guidance breaks down the planning process into 9 steps:

- Step 1 Determine the Planning Area and Resources
- Step 2 Building the Planning Team
- Step 3 Create an Outreach Strategy
- Step 4 Review Community Capabilities
- Step 5 Conduct a Risk Assessment
- Step 6 Develop a Mitigation Strategy
- Step 7 Keep the Plan Current
- Step 8 Review and Adopt the Plan
- Step 9 Create a Safe and Resilient Community

Step 2: Hazard Mitigation Planning Committee

The Region 5 Hazard Mitigation Planning Committee consists of the Regional Steering Committee represented by each of the counties/tribes Emergency Management Coordinators. As well as the County Planning Teams made up of tribal, county and municipal staff as well as stakeholders within each county. Jeff noted that every update cycle is an opportunity to include additional local government participating jurisdictions, which are defined by FEMA as any entity with a governing board. This includes special service districts. Some special service districts represented on the meeting indicated they may want to join; Jeff recommended they let their county coordinator know soon so they can be folded formally into the plan update effort.



Currently the Hazard Mitigation Planning Committee is working through Steps 3-5 of the 9-step planning process with the next steps of developing an outreach strategy, reviewing Region 5 capabilities, and conducting the Risk Assessment. Step 6 involves developing a mitigation strategy. Steps 7 and 8 involve

final plan adoption and implementation and ensuring the adopted plan builds a safer and more resilient community.

Step 3: Public Outreach Strategy

FEMA requires we provide two opportunities for public involvement during the planning process: during the draft stage and prior to plan approval. Public involvement will include online surveys during the planning effort and will look to the participating jurisdictions to assist with advertising these opportunities. In addition, the County Planning Teams are asked to post the draft plan online and solicit comments prior to the submittal to the State and FEAM. The Wood team will be responsible for documenting this process; this may involve documenting specific meetings with stakeholders or other organizations.

Step 4: Capabilities Assessment

Jeff explained that the team will examine existing policies and programs and evaluate the effectiveness of the mitigation gaps and shortfalls to see where there are areas for improvement. He stated our team will also look at each jurisdiction's fiscal abilities to understand where there could be funding options for mitigation not limited to grants. The capability assessment is being aligned with current FEMA planning guidance and will be an area of focus during the update.

Step 5: Risk Assessment

Jeff discussed the three components of the risk assessment. He covered the aspects of natural hazards included in the assessment and how those hazards overlap with community assets. He discussed where there is overlap between the hazards and assets is where we have risk (e.g., potential for losses).

The vulnerability assessment looks at a range of assets in the Region: residential/commercial structures and critical facilities and infrastructure. The Wood team will align this update with the more recent FEMA Community Lifeline framework. Understanding risks to lifeline facilities and identifying ways to minimize those risk with mitigation actions, will better position the plan for grant funding. He also stated we will look at development trends and natural resource areas in terms of assets that may warrant protection from hazard impacts.

Step 6: Mitigation Strategy

The Mitigation Strategy begins with reviewing the plan's existing goals, which are broad overarching statements of what we want to achieve. Goals are supported by mitigation actions, which are specific and measurable. The group reviewed each of the four counties goals from the 2017 plan and Jeff noted these will be looked at more closely in future meetings.

Jeff shared different reference guides for mitigation action alternatives, such as FEMA's Mitigation Ideas document and the National Flood Insurance Program Community Rating System (NFIP CRS) guidance. The HMPC will need to review and select the alternatives for new actions as part of the plan update process. Each jurisdiction will need at least one new action, and actions will need to be prioritized. This will be done by applying selection and prioritization criteria, such as whether it will work, is it cost-beneficial, affordable, legal, and fair etc. This process will occur at a future planning meeting/workshop.

Steps 7 & 8: Plan Maintenance and Adoption

Jeff explained there will be three drafts of the plan: (1) Internal HMPC Review; (2) Public Review (3) State and FEMA Review. As part of the first review, the Regional Steering Committee review and agree upon plan maintenance procedures. Each county, tribe and municipality within Region 5 will need to readopt the plan to secure the buy-in for the process.

Objectives and Schedule for Regional Plan Update 2022

Jeff reviewed the key elements of the plan update process which include, updating the risk assessment to reflect current hazards, past events and risk and vulnerability. The 2017 mitigation actions will be assessed, including developing new actions and documenting progress that has been made in terms of mitigation in the Region, as well as noting in changes in priorities.

The plan expires in February 2023, and the update will be developed over the next 9-12 months. The next meeting will focus on the Risk Assessment and Goals update, which will require the Wood team to conduct the assessment itself and complete the analysis. Other forthcoming deliverables include the public survey. The next 2 planning meetings will be in the spring and summer with exact dates to be determined; those meetings may be in-person workshops in each county, unless COVID Pandemic trends dictate additional web-based workshops in the future, or if the preference is for virtual workshops.

Roles of the Multi-County Steering Committee and County Planning Committees

The county and tribal Emergency Management Coordinators will comprise the Steering Committee, which is a committee that will work with Wood throughout the process. Each Coordinator will convene a County Planning Team (CPT) or Tribal Planning Team (TPT) within each participating entity. The CPTs or TPTs will include members of appropriate departments, e.g., road and bridge, planning, public works, police/fire/public safety, and emergency management and include municipalities and could include special districts (e.g., fire and school). The coordinators will be responsible for identifying members of their HMPC and assisting with meeting logistics. The CPTs and TPTs are responsible for participating in the planning process, assisting in the updating the plans content and reviewing the draft plans to ensure it meets specific needs and local issues. Finally, each county and each tribe will need to formally adopt the plan. By doing so the plan will maintain eligibility for FEMA mitigation funds.

Stakeholders, which include representatives from the state or federal government, private, non-profit entities or other interested organizations have various options for their level of participation:

- Attending planning meetings or staying in the loop via email list
- Providing data and information
- Partner on mitigation efforts
- Review the draft plan

Review of Identified Hazards

Amy Carr led brief discussion on the past hazard rankings, noted that there are some differences across jurisdictions for the significance rankings since that question was asked by a participant. The 2017 Region 5 plan addressed the following natural hazards:

- Avalanche
- Dam Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Cold
- Flood
- Hail
- Landslide
- Lightning
- Mine Subsidence
- Tornado
- Wildfire
- Wind (includes high and straight winds)
- Winter Storm
- Hazardous Materials

The group also reviewed the hazard rankings of the 2020 Wyoming Statewide Hazard Mitigation Plan which in addition to the Region 5 hazards listed above also included volcano. Volcano was added to the State plan last year.

Slido Poll: Do you generally agree with the current list and ratings of hazards? 87% replied Yes, 13% No.

Slido Poll: What other hazards should be considered? (see results in attachment)

The group discussed if there were other hazards that should be considered that were not listed on the 2017 hazard slide. The following hazards and hazard instances were discussed:

- Power outages/Extended Utility Failure and supply chain issues were also mentioned to be considered. Jeff noted the SHMP includes these as cascading hazards.
- Radiological incidents, it was noted that there is a potential new nuclear power plant which is currently in the planning process.
- The smoke hazard from wildfires in the state and the Western U.S.
- Supply chain issues and associated economic impacts as a cascading impact of hazards should be noted in the plan with the appropriate hazards.

Additional Slido Poll Questions during the meeting are listed below, with responses in the attachment:

- Have there been any growth and development trends in past 4 years that may increase or decrease vulnerability to hazards (i.e., more homes in wildland urban interface, floodplain development pressure etc.)?
 - o Chat log: more people, more strain on systems
 - o Chat log: aging infrastructure in small towns who have limited funding opportunities.
- Do you have specifics on any hazard impacts in past 4 years (damage assessments, people and property impacts, repair costs etc?)
 - o Wind events was mentioned
 - o Damage to homes from hail
 - o The smoke hazard from wildfires

- o Sam Sumrall noted the recovery from the Roosevelt fire is still ongoing
- o Chat log: wind event in Sublette Sept 7-8th of 2020
- What other existing or recent plans, reports, or studies should be reviewed for this planning process?
 - o USFS might have done a study or report on the blowdown event of 2020
 - o Chat log: city of lander 205 study
 - o Chat log: New Fork Irrigation District Dam Safety Plan ,done in 2010

Coordination with Other Agencies, Related Planning Efforts, and Recent Studies

A discussion was held on how to coordinate this planning process with other agencies, related planning efforts and recent studies in order to meet one of the DMA planning requirements. This is also an opportunity to develop a holistic plan and integrate related mitigation efforts where possible. No additional agencies outside of those already identified were noted during the kickoff meeting.

Additional Slido Poll Questions during the meeting are listed below, with responses in the attachment; chat and discussion is noted below:

- What opportunities exist to coordinate or integrate the Hazard Mitigation Plan with other planning mechanisms?
 - o Chat log: you may want to check the State's Intended Use Plan for proposed projects
- Are there any upcoming opportunities for outreach at scheduled public meetings or events?
- What key stakeholders should be involved in this process?
 - o most folks on the meeting felt that everyone necessary was represented
 - o Wyoming Water Development Commission was suggested in the Chat log.

Initial Information Needs/Next Steps

A Plan Update Guide will be developed by Wood to gather data and updated information from the Planning Teams. Each county and municipality will be asked to complete the data based on various department inputs. The Guide will capture recent hazard impacts in the last in the last five years as well as input on capability assessment updates.

GIS data collection is already in process; local GIS portals for Sublette and Fremont counties will be leveraged, along with data used for the previous planning effort and the 2020 WY State Plan update.

Stakeholders are asked to provide additional information on hazards, related planning, and project efforts as applicable. As well as stay in the loop of the planning process via emails from the county and tribal coordinators.

The group was polled 'What is your preference on how future meetings should be held?' 64% responded Virtual, 7% In Person and 29% No preference.

Attachments: Sign in summary from Meeting Chat, Log, Slido Poll results and PowerPoint Slides

Attendees based on Chat Log input:

1. Jeff Brislawn, Wood Environment & Infrastructure
2. Amy Carr, Wood Environment & Infrastructure
3. Christopher Johnson, Wood Environment & Infrastructure
4. Cameron Nelson, Wood Environment & Infrastructure
5. Harvey Spoonhunter, Northern Arapaho Tribe Emergency Management Coordinator
6. Clinton Glick, Eastern Shoshone Tribe Emergency Management Coordinator
7. Kathy Osbourne, Fremont County EMA, Admin Assistant
8. Vonda Huish, Fremont County EMA, fcema@fremontcountywy.gov, 307-856-2374
9. Gary Hamlin, Fremont County School District #6, Facilities Coordinator
10. Shad Cooper, Sublette County Unified Fire
11. Tyler Maxfield, Big Piney, Mayor
12. Shamika McDonald, Wyoming State Hazard Mitigation Officer
13. KC Lehr, Sublette County Sheriff
14. Douglass Linn, BLM Field Manager, Pinedale Field Office
15. Troy Zickefoose, Superintendent, Fremont County School District #6
16. Sam Sumrall, Board President, Hoback Ranches Special Improvement District
17. Lance VandenBoogart, Meteorologist, National Weather Service, Riverton, Wy
18. Emily Alvarez, Community Planner, FEMA R8
19. Tina Nelson, New Fork Irrigation District
20. Tiffany Hayes, Assistant Field Manager – Minerals and Lands, Lander Field Office, Bureau of Land Management
21. Seth Wittke, Wyoming State Geological Survey, seth.wittke@wyo.gov, 307-766-2286
22. Mike Quiver, Northern Arapaho Water and Sewer Dept., Director
23. Susan Briggs-Stanfill, Sublette County EMS
24. Nancy Tolley, Sublette County, RUGRID Special District
25. Sam Bixler, Economic Development Marbleton
26. Steve Baumann
27. Gordon H
28. Jim Mitchell
29. "Mike"
30. Johnny Friday

13:22:30 From Jim Mitchell to Everyone:

Steven Kipp Sublette PHRC

13:22:49 From Jim Mitchell to Everyone:

Jim Mitchell Sublette County EM

13:23:02 From Amy Carr to Everyone:

Hi everyone, thank you for joining us today. There will be live polls throughout the meeting. Please go to slido.com and Enter code #R5Kickoff to participate in the polling.

13:32:11 From Amy Carr, Wood to Wyoming Homeland Security(Direct Message):

Are you able to record? Its telling me I need permissions.

13:34:26 From Amy Carr, Wood to Wyoming Homeland Security(Direct Message):

thank you! 😊

13:34:31 From Wyoming Homeland Security to Amy Carr, Wood(Direct Message):

You're welcome!

13:37:33 From Gary Hamlin to Everyone:

Gary Hamlin

13:37:41 From Shad Cooper to Everyone:

Shad Cooper

13:37:45 From Gary Hamlin to Everyone:

FCSD#6

13:37:51 From Tyler Maxfield to Everyone:

Tyler Maxfield Mayor Big Piney

13:37:52 From Sublette County Sheriff KC Lehr to Everyone:

KC Lehr, Sublette County Sheriff

13:37:54 From Wyoming Homeland Security to Everyone:

Shamika McDonald, WY Office of Homeland Security, State Hazard Mitigation Officer

13:37:56 From Gary Hamlin to Everyone:

Facilities coordinator

13:37:56 From Douglas Linn to Everyone:

Doug Linn, Bureau of Land Management - Field Manager - Pinedale Field Office

13:37:57 From Shad Cooper to Everyone:

Shad Cooper - Sublette County Unified Fire

13:38:01 From Troy Zickefoose to Everyone:

Troy L. Zickefoose, Superintendent Fremont County School District #6

13:38:02 From Vonda Huish, FCEMA, Fremont Co. to Everyone:

Vonda Huish, Fremont County Emergency Management Agency, fcema@fremontcountyywy.gov, 307-856-2374

13:38:04 From Sam Sumrall to Everyone:

Sam Sumrall

13:38:15 From Kathy Osborne to Everyone:

Kathy Osborne Fremont County Emergency Management Admin Assistant

13:38:22 From Lance VandenBoogart - NWS Riverton to Everyone:

Lance VandenBoogart - Meteorologist - National Weather Service: Riverton, WY

13:38:38 From Emily Alvarez, FEMA R8 (she/her) to Everyone:

Hi, All! I'm Emily Alvarez and am a Community Planner with FEMA R8. I'm on the team that handles plan review all things hazard mitigation planning. Just here to be a resource 😊 Great to meet you all.

13:38:43 From James and Tina Nelson to Everyone:

tina Nelson new fork irrigation district

13:38:44 From Tiffany Hayes to Everyone:

Tiffany Hayes, Lander Field Office Bureau of Land Management (BLM), Assistant Field Manager- Minerals and Lands

13:38:48 From Seth Wittke, WSGS to Everyone:

Seth Wittke - Wyoming State Geological Survey

seth.wittke@wyo.gov 307 766 2286

13:38:56 From mike.quiver to Everyone:

Mike Quiver Northern Arapaho Water and Sewer Dept. (Director)

13:39:05 From Sam Sumrall to Everyone:

Sam Sumrall Board President Hoback Ranches Special Improvement District

13:39:19 From EMS to Everyone:

Susan Briggs-Stanfill, Sublette County EMS

13:40:13 From Rob Tolley to Everyone:

Nancy Tolley Sublette County, RUGRID special district, former president

13:41:04 From Wyoming Homeland Security to Everyone:

Shamika McDonald 307.777.4914 Shamika.mcdonald1@wyo.gov

13:41:20 From Amy Carr, Wood to Everyone:

slido.com Meeting code: R5Kickoff

13:42:11 From Sam Bixler to Everyone:

Sam Bixler, Economic Development Marbleton, also Municipal Judge Marbleton and Pinedale. Note: I have an unstable internet connection

13:42:21 From Emily Alvarez, FEMA R8 (she/her) to Everyone:

Love the board gaming!

13:43:03 From Emily Alvarez, FEMA R8 (she/her) to Everyone:

Also fully support the D&D 😊

13:43:16 From EMS to Everyone:

no

13:43:30 From Sam Bixler to Everyone:

yes

14:21:42 From Amy Carr, Wood to Everyone:

<https://drive.google.com/drive/folders/1g1WZZajHwPAK6gIrg0D6ikw79BVQUq6g?usp=sharing>

14:25:01 From Jeff Brislawn, Wood to Everyone:

Jeff Brislawn, Project Manager, Wood

14:29:26 From Gary Hamlin to Everyone:

Will there be availability for this zoom meeting recording via email?

14:30:55 From EMS to Everyone:

Do stakeholders qualify for funding by participating with

14:33:29 From Kathy Osborne to Amy Carr, Wood(Direct Message):

Can you please send me the slide show?

14:43:26 From EMS to Everyone:

What is the scale based on'

14:43:58 From EMS to Everyone:

L= m= h=?

14:44:04 From Christopher Johnson to Amy Carr, Wood(Direct Message):

Do we want to ask the people who said no why they say that? Or just see what they say to the next question?

14:47:09 From EMS to Everyone:

Sublette County has aging dams on multiple lakes....M instead of L?

14:47:22 From Wyoming Homeland Security to Amy Carr, Wood(Direct Message):

Heading to the restroom. BRB.

14:48:15 From Troy Zickefoose to Everyone:

Good point! There would be lots of stranded people.

14:50:07 From Wyoming Homeland Security to Amy Carr, Wood(Direct Message):

Back

14:51:39 From EMS to Everyone:

Wind events

14:52:31 From Sam Bixler to Everyone:

Covid has increased population which has increased housing costs

14:53:29 From Sam Sumrall to Everyone:

Ongoing recovery from Roosevelt fire and anticipating future damages

14:53:46 From Jim Mitchell to Everyone:

wind event in Sublette Sept 7-8th of 2020

14:56:15 From EMS to Everyone:

more people, more strain on systems

14:56:54 From Gary Hamlin to Everyone:

Aging infrastructure in small towns who have limited funding opportunities.

14:59:56 From Mike to Everyone:

city of lander 205 study

15:01:26 From James and Tina Nelson to Everyone:

New Fork Irrigation District Dam Safety Plan ,done in 2010

15:01:44 From Emily Alvarez, FEMA R8 (she/her) to Everyone:

I have to run. Thanks, everyone!

15:03:20 From Sam Bixler to Everyone:

You may want to check the State's Intended Use Plan for proposed projects

15:03:50 From EMS to Everyone:

Wyoming Water Development Commission

15:10:12 From Sam Bixler to Everyone:

In person

15:10:18 From EMS to Everyone:

virtual

15:11:15 From Kathy Osborne to Everyone:

Thank you

15:11:16 From Sam Sumrall to Everyone:

Thanks to all.



WY R5 Kickoff

16 - 22 Feb 2022

Poll results

Table of contents

- If you didn't have to be in the meeting today, what would you rather be doing?
- Did you participate in the 2017 plan?
- Do you generally agree with the current list and ratings of hazards?
- What other hazards should be considered?
- Have there been any growth and development trends in past 4 years that may increase or decrease vulnerability to hazards (i.e. more homes in wildland urban interface, floodplain development pressure etc.)?
- Do you have specifics on any hazard impacts in past 4 years (damage assessments, people and property impacts, repair costs etc?)
- What other existing or recent plans, reports, or studies should be reviewed for this planning process?
- What opportunities exist to coordinate or integrate the Hazard Mitigation Plan with other planning mechanisms?
- Are there any upcoming opportunities for outreach at scheduled public meetings or events?
- What key stakeholders should be involved in this process?

Table of contents

- What is your preference on how future meetings should be held?

**If you didn't have to be in the meeting today,
what would you rather be doing?**

013

Dungeons & Dragons
Sitting in snow Ice fishing
Snowmobiling
Biking Skiing Work Snowboarding
Reading Walking dogs Heading South
Board gaming Looking at deer
Inspecting fire control p

Did you participate in the 2017 plan?

0 1 4

Yes



No



Do you generally agree with the current list and ratings of hazards?

0 1 5

Yes



No



What other hazards should be considered?

008

- chemical spills due to unforeseen accidents in transporting of chemicals
- Large scale erosion post disaster
- Transportation
- Multiple power outages
- Radiological due to new construction of power plant
- Ours are mainly fire and flood risk
- To what extent if any would "other national or regional" emergencies that could limit supply lines be considered in this effort.?
- Extended utility outages

Have there been any growth and development trends in past 4 years that may increase or decrease vulnerability to hazards (i.e. more homes in wildland urban interface, floodplain development pressure etc.)?

- Increased population growth
- Home growth is up
- More new housing has been built in last two years in Sublette. jcm
- Agree with the rest
- yes
- home sales are high in Sublette County and supply is limited so the influx with new construction is high
- Yes. More growth and development in our district. Housing especially.

Do you have specifics on any hazard impacts in past 4 years (damage assessments, people and property impacts, repair costs etc?)

007

- Limited hail damage to homes from the wind/blowdown event. Jim Mitchell would know the year.
- Will need to check
- The smoke hazard from the western area fires? Impacts on folks with breathing difficulties.
- nothing comes to mind at this time
- Need to research
- Flood insurance
- N

What other existing or recent plans, reports, or studies should be reviewed for this planning process?

002

- take a look at how the climate is changing
- may want to see if the USFS did a study or report on the blowdown event of 2020

What opportunities exist to coordinate or integrate the Hazard Mitigation Plan with other planning mechanisms?

- Future Bureau of Land Management
Resource Management Plan
revisions

Are there any upcoming opportunities for outreach at scheduled public meetings or events?

001

- We have an LEPC meeting in March

What key stakeholders should be involved in this process?

003

- More input from all the towns
- I think Fremont County's list is comprehensive and inclusive
- I see all seem to be represented

What is your preference on how future meetings should be held?

0 1 4

Virtual Meetings



In Person Meetings



No preference



From: [Fremont County EMA](#)
To: [Brislawn, Jeff P](#); [Carr, Amy](#); [Harvey Spoonhunter](#); [Clint Glick](#); ["Billy Meeks"](#); ["Carl Freeman"](#); ["Craig Haslam"](#); ["Ernie Over"](#); [fcema@fremontcountyywy.gov](#); ["Larry Allen"](#); ["Ryan Lee"](#); [sdwalters@wyoming.com](#); [steve.baumann@fremontcountyywy.gov](#); [tara.berg@fremontcountyywy.gov](#); ["City of Lander Airport Fire Hall Manager"](#); [dubois@wyoming.com](#); ["Eric Murphy"](#); [Kathy Shoopman](#); [kbutterfield@rivertonwy.gov](#); [Lance Hopkin](#); ["Mike Franchini"](#); [rfdfirefighter51@gmail.com](#); [rgard@rivertonwy.gov](#); [rsfossen@landerwyoming.org](#); [speters@landerwyoming.org](#); ["Town of Dubois"](#); ["Town of Hudson"](#); ["Town of Pavillion"](#); ["Town Of Shoshoni"](#); ["Town of Shoshoni PD"](#); ["Andy Frey"](#); ["Darick Eisenbraun"](#); ["Diane Lane"](#); ["Josh Hedden"](#); ["Michael Harmon"](#); [bthoren@shoshonischools.org](#); [cathy.meyer@wy.nacdn.net](#); [community@windriver.org](#); [dbarker@landerschools.org](#); [dsmith@fortwashakieschool.com](#); [fremontfirewise@wyoming.com](#); [Gary Michaud](#); ["Jeffrey City VFD"](#); ["JoAnn Flanagan"](#); [midvale@wyoming.com](#); [pacd.general@gmail.com](#); [roy.brown@fremont38.com](#); [ssplichal@fremont2.org](#); ["Tony Zickefoose"](#); [amalcolm@uwyo.edu](#); [brian.russell@wyo.gov](#); [cmarshal1@uwyo.edu](#); [cody.beers@wyo.gov](#); [erin.campbell@wyo.gov](#); ["Seth Wittke"](#); [shamika.mcdonald1@wyo.gov](#); ["Chris Jones"](#); [sschacht@fs.fed.us](#); [Tom Sunderland](#)
Cc: [vonda.huish@fremontcountyywy.gov](#); [Kathy Osborne](#)
Subject: Region 5 Hazard Mitigation Plan Update Meeting #2
Date: Wednesday, June 1, 2022 7:45:58 AM

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Good Morning All,

This notice is for a reschedule of the 2nd of 3 primary planning meetings on the update of the Region 5 Hazard Mitigation Plan, specific to Fremont County and the Northern Arapaho and Eastern Shoshone Tribes. The rescheduled meeting will take place Thursday June 9, 2022 1:00-3:00 pm (MST) on Zoom. The purpose of the meeting is to review highlights of the updated hazard identification and risk assessment. The planning consultant Wood will present information on key hazard vulnerabilities such as wildfire, flood, landslides etc., but will also be looking for feedback on specific areas of concern that may be areas for related mitigation actions. We will also be discussing the plan's overarching mitigation goals to see if they are still relevant or need adjusting. Please try to attend in accordance with participation requirements. This meeting is intended for county, municipal and tribal departments, participating special districts and interested stakeholders.

The following is the Zoom Link for participation;

Fremont County is inviting you to a scheduled Zoom meeting.

Topic: Region 5 Hazard Mitigation Plan Update

Time: Jun 9, 2022 01:00 PM Mountain Time (US and Canada)

Join Zoom Meeting

<https://us02web.zoom.us/j/88103441007?pwd=ZFImb3FFaW1tUy9FYUhCelhYbTlhQT09>

Meeting ID: 881 0344 1007

Passcode: 071814

One tap mobile

+12532158782,,88103441007#,,, *071814# US (Tacoma)

+13462487799,,88103441007#,,, *071814# US (Houston)

Dial by your location

+1 253 215 8782 US (Tacoma)

+1 346 248 7799 US (Houston)

+1 669 900 6833 US (San Jose)

+1 301 715 8592 US (Washington DC)

+1 312 626 6799 US (Chicago)

+1 929 205 6099 US (New York)

Meeting ID: 881 0344 1007

Passcode: 071814

Find your local number: <https://us02web.zoom.us/j/8440111111>

Wyoming Region 5

Hazard Mitigation Plan Update Meeting #2

Agenda

Date: Thursday, May 19, 2022
9:00am – 11:00 am MST

Meeting at: Zoom Meeting
<https://us02web.zoom.us/j/85422784275?pwd=MGhka084c3haallENEpsT3VvaVhmZz09>
+1 346 248 7799
Meeting ID: 854 2278 4275
Passcode: 0001

Subject/Purpose: The purpose of the meeting is to review the updated Hazard Identification and Risk Assessment portion of the Wyoming Region 5 Regional Hazard Mitigation Plan. Following the review of the Risk Assessment the group will be discussing update needs for the Mitigation Strategy portion of the Regional HMP.

Attendees: Hazard Mitigation Planning Committee (Fremont County, Sublette County and the Wind River Reservation Planning Teams) and Stakeholders

1. Introductions
2. Review of the hazard mitigation planning process
3. Hazard Identification and Risk Assessment Update Review and Highlights
4. Capability Assessment Update
5. Mitigation Strategy Update Needs
6. Next steps
7. Questions and answers

Summary of the Wyoming Region 5 Multi-Hazard Mitigation Plan Update

Risk Assessment and Goals Meetings

Sublette County and Wind River Reservation (Northern Arapaho Tribe)

May 19, 2022

Introductions and Opening Remarks

Jeff Brislawn, Project Manager, and Amy Carr, Deputy Project Manager, with Wood Environment & Infrastructure Solutions Inc., the consulting firm hired by WOHS to facilitate the plan update process, began the meetings with welcoming remarks. Emergency Management Coordinators from Sublette County and the Northern Arapaho Tribe, as well as members of jurisdictions within these areas, participated in the meeting. A goals update, a hazard risk significance summary overview, and a capability assessment update were covered during the meeting. This is the first of two gatherings to cover the risk assessment and goals for the planning process for the planning area. Fremont County and Eastern Shoshone Tribe were not able to attend this meeting but will have a meeting in the near future.

May 19 Sublette County and Northern Arapaho Tribe
 9:20 am – 11:20 am
 Attendees: 16*
 Included U.S. Forest Services and Fire District

Attendance:

Abram Pearce	Town of Pinedale	Public Works Director
Harvey Spoonhunter	Northern Arapaho Tribe	Emergency Management Tribal EMA Manager
Ivan	US Forest Service	Pinedale District Ranger
Jim Mitchell	Sublette County	Emergency Management Coordinator
KC Lehr	Sublette County	Sheriff
Sam Bixler	Town of Marbleton	Economic Development
Shad Cooper	Sublette County	Fire
Shannon Harris	Sublette County SD #1	Superintendent
Steven Kipp	Sublette County	Public Health Response Coordinator

Jeff Brislawn	Wood	Project Manager
Amy Carr	Wood	Deputy Project Manager
Chris Johnson	Wood	Hazard Mitigation Planner/GIS Specialist
Natalie Schoen	Wood	Hazard Mitigation Planner

*3 participants called in

Review of the Hazard Mitigation Planning Process

A PowerPoint presentation was presented by Jeff Brislawn and Amy Carr with Wood. Jeff started the meeting by outlining the FEMA nine-step planning process and discussed the project status, now in step 5. The online public survey was successful in engaging the community and received a total of 96 responses. These responses indicate that community members perceive the highest risk hazards as drought, wind, winter storm, wildfire, and extreme cold.

Jeff also reviewed the two new jurisdictions that were added to the planning process and who will be adopting the plan: Hoback Ranches Improvement District and Redstone Upper Green River Improvement District, both in Sublette County. Jeff noted that the 5-year update is required to maintain eligibility for FEMA Hazard Mitigation Assistance Grants; funding is increasing nationally for mitigation with the new Building Resilient Infrastructure and Communities (BRIC) grant, and that jurisdiction participation and input will be increasingly important as we move forward in the planning process.

Review of Hazards and Vulnerability Assessment Update

Jeff outlined the general risk assessment requirements before beginning a detailed discussion of each hazard. He presented details on each hazard that will be included in the draft updated risk assessment chapter. Refer to the Risk Assessment PowerPoint presentation and draft update of the Hazard Identification and Risk Assessment (HIRA - forthcoming) chapter for specific details on each hazard.

Several valuable details were learned during the risk assessment conversation among participants. Highlights of the discussions are noted by hazard in the tables below.

Hazard or Topic	Meeting Discussion
Avalanche	- Fremont and Wind River Reservation rated as low risk; Sublette is rated as medium - Jeff explained that WY has the 6th highest number of recorded avalanche fatalities. A majority occur in Teton counties, but WY Region 5 has backcountry activities in the wintertime so there is risk - Jeff noted one fatality on west side of Sublette County - No comments from group

Dam Failure	• Fremont and Sublette listed as medium risk; Wind River Reservation rates as high • Jeff explained that there has been an increase in the number of high hazard dams since the last HMP, which could be because structures were built downstream • KC Lehr with Sublette County commented that the Fremont Lake Dam should be included in the study because it could have significant impacts • Sam Bixler commented that the Middle Piney Dam is currently being reconstructed • Jim Mitchell with Sublette County commented that the state engineer changes and there is a 11-million-dollar improvement project for the dam flow and release system • Jeff explained that some dams might not meet the criteria to get on the engineers list, but they will be included in the plan. Jeff also explained that the rating system doesn't consider the condition of the dam • Jeff noted that only publicly available data can be used in the plan for homeland security reasons • Harvey Spoonhunter with Wind River Reservation commented that the lake in the NW corner of the reservation (above Bull Lake) should also be noted
Drought	• All three areas rated as high risk • Amy discussed how there has been 19 USDA Disaster Designations since 2012 in the area for drought, 17 of which were Fast Track Designations, which indicates the drought was very severe in the region • Crops/vegetation and recreation/tourism are vulnerable to drought, as well as the regional water supply • Jim Mitchell noted that the Small Business Association sent out information on drought relief funding in the county • Abram Pearce asked about political impacts of drought, such as the expiration of the Colorado River Compact and that most of the water rights in the area are established after it's adoption
Earthquake	• All three areas rated as medium risk • Fremont County is 6th highest in the State for earthquake losses and Sublette County is 8th highest in the State • HAZUS and USGS probabilistic seismic hazard maps • Cascading hazards such as landslide, rockfall, liquefaction, and fire • No additional comments from the group
Expansive Soils	• All three areas rated as low risk • Comments from Abram Pearce and Jim Mitchell on damages to roads and infrastructure from freeze and thaw impacts to soil expansion • Abram Pearce also commented that there has been money designated to projects to remove top 24 inches of materials/clay
Extreme Cold	• All three areas rated as low risk • Amy Carr reviewed the 20 extreme cold events between 1996-2020 • Impacts from extreme cold lead to cascading events such as frozen pipes

	• Crops are very vulnerable, the USDA notes 3,000+ acres lost due to extreme cold in the region (all events were noted in Fremont) • Shad Cooper said that the risk rating for this hazard should be increased and other cascading events due to extreme cold include house fires, which skyrocket during the winter months when people run their heaters to counteract the cold weather • Sam Bixler added that water mains also tend to burst during cold weather events and agrees that the risk rating should be increased • Bill Kluck and KC Lehr agree that the risk rating should be increased
Flood	• Fremont and Wind River Reservation rated high risk; Sublette rated as medium risk • 40 flood events in Fremont County since 1998 and 6 flood events since 1999 • 12 flood events in Wind River Reservation and a Presidential Disaster Declaration for flooding in 2017 • FEMA flood mapping and HAZUS data used for risk analysis (1% and 0.2% annual chance) • Transportation facilities are at high risk of flooding, especially bridges • Comment from Abram Pearce regarding the date of the current FEMA FIRM specific to Pinedale. Wanted to be sure that we note in the plan that the FIRM (effective in 1986) may not be the most accurate data for the town of Pinedale • Jeff explained that the flood map used for Sublette County is an old FEMA map that was digitized and HAZUS is approximate data used for planning purposes, but that the plan will discuss the limitations of this data, but it is the best available data for the area • Jeff noted that flood risk to structures has increased in Sublette since the last plan, in part due to improved parcel analysis, but it may also be reflecting development trends.
Hail	• All three areas rated as medium risk • Hail is generally associated with summer storms and is a prevalent hazard in Region 5, with 110 events since 1955 • 12 events with 1.75-inch hail (golf ball size) in the region • Amy reviewed several notable events in the region that resulted in significant damages and discussed vulnerabilities to hail, such as outdoor workers, livestock and crops, and outdoor property • No comments from the group
High Wind and Downbursts	• All three areas rated as medium risk • High wind has a constant presence in Wyoming and the Region has experienced 340 high wind events (occurs generally in the winter months and has average higher wind speeds) and 128 thunderstorm events (occurs in summer months along with thunderstorms and has generally lower wind speeds) • Amy explained how wind has caused significant damages in the region and discussed the notable events

	• KC Lehr suggested that high wind and down bursts increases the risk rating to high and explained how difficult it is to get people in the backcountry out safely during an event • Bill Kluck and Jim Mitchell agree with raising the risk rating
Landslide/Rockfall/Debris Flow	• All three areas rated as medium risk • Jeff explained these hazards are most likely to happen on/near steep terrain • Roads such as forest service roads and railroads are at risk, especially in the Wind River Valley • No comments from group
Lightning	• All three areas rated as high risk • Amy highlighted the 8 recorded lightning events in the region since 1969, one of which caused a fatality • Amy discussed the vulnerabilities to lightning, including outdoor enthusiasts and electricity-dependent people and operations • Steven Kipp commented on the algorithm used by US HHS EmPower map to randomize Medicare beneficiary information often over inflates numbers in low populated areas. For example, if there is a zip code with less than 11 people their formula automatically bumps it up to a minimum of 11 people
Mine Subsidence	• All three areas rated as low risk • Jeff explained that property and infrastructure damage are associated with mine subsidence in WY communities, but dollar amount isn't available. It is best to avoid placing new development in these areas • No comments from group
Tornado	• All three areas rated as low risk • Amy discussed the 26 events that have occurred in the region since 1950 and the notable events that have occurred in the area • Communication systems and equipment are vulnerable to tornado events • No comments from the group
Severe Winter Weather	• All three areas are rated as high risk • Jeff discussed the 1,014 past winter storms events in the region and the various vulnerabilities to winter weather, such as possible isolation from road closures • Comment from Steven Kipp emphasizing how transportation impacts are critical for Sublette County • Question on whether airports are looked at specifically
Wildfire	• All three areas rated as high risk • Two federal disaster declarations: Roosevelt Fire 2018 (Sublette) and Lava Mountain Fire 2016 (Fremont) • Kates Basin Fire 2000 burned significant portion of Wind River Reservation • Highest wildfire risk near WUI and highly populated areas • Increasing temperatures, prolonged drought, and greater winds overlapping with fire season creates higher risk for wildfire • Comment from Shad Cooper on the ongoing update of Sublette county's CWPP, updated risk information. Jeff

	requested that any helpful information to inform the HMP update be provided.
HazMat	• All three areas rated as low risk • Amy reviewed the 648 hazardous material incidents since 1990, which can happen at a facility, during transportation, or at the storage site. • There are 9 Risk Management Plan Facilities in the region, 5 in Fremont and 4 in Sublette • Wind River Reservation noted in the previous plan that the railway is a significant concern to the nearby river and reservoir if there was a hazardous material incident. Trains have derailed in the past on this railway in Wind River Canyon.

Amy ended this section of the presentation by asking the group what ratings should be changed, and what should the new ratings be. Sam Bixler suggested that the plan cover loss of communication risk. Sublette County experienced issues with the 911 services. KC Lehr emphasized this is primarily a service provider issue, and he feels confident that with the redundancies in the communication system, there will never be a time when they completely lose communication.

The group agreed that high wind/downburst and extreme cold risk ratings should be increased to 'high' (or at least to 'medium' for extreme cold). This is due to the various cascading events associated with these hazards, such as house fires, water main breaks, isolation, and inability to receive goods due to road closures, and threat to human life and safety. Jeff informed the group that if these ratings are raised, mitigation actions will need to be added to the plan associated with the hazards.

Capability Assessment Update

Jeff briefly reviewed highlights of existing capabilities in the county to mitigate hazards. He explained that this information came from the Plan Update Guides that were sent out, and ideally every jurisdiction would return one. The counties noted the following about capabilities and Jeff asked the group to consider what opportunities there are to improve them:

Fremont County	Jeff displayed this slide, but since no members of Fremont County were present at the meeting, there was no discussion • County Land Use Plan 2004 • City of Lander Master Plan 2012 • County Subdivision Regulations • County Community Wildfire Protection Plan 2012 and 2014 update • Fuel reduction activities • County Drought Task Force • LEPC • Firewise efforts • County and municipal participation in NFIP
Sublette County	• County Comprehensive Plan includes Natural Hazards • Zoning, Land use and development regulations

	• Burn bans • Big Piney and County participation in NFIP • Pinedale Drainage Study and 5-year Plan 2010 • County Community Wildfire Protection Plan 2006 and 2016. (Updating in 2022) • Fuel reduction activities • Firewise Assessments • Haz Mat evacuation plans
Wind River Reservation	• Wind River Reservation Land Use and Development Plan • Zoning and Subdivision Ordinance • Floodplain Ordinance • Building Codes • Community Evacuation Plans • Lightning Detectors in Public Areas • Partnerships with Fremont County and Rural Fire Protection Districts • Wind River Water Code • Agricultural Resource Management Plan 2018 • Drought Adaption Plan

Mitigation Strategy Update

The CPT Reviewed a list of typical goal statements for hazard mitigation plans, drawn from their existing plans other county plans in the region, and the Wyoming State Hazard Mitigation Plan. The counties in the region were asked to review their specific goals and consider changes.

Fremont County Goals

1. Protect life and property from hazard impacts
2. Increase public awareness of hazards
3. Protect natural systems from hazard impacts
4. Strengthen partnerships related to hazard mitigation
5. Enhance emergency services and reduce impacts to critical infrastructure

Suggested changes: None at this time

Sublette County Goals

1. Protect life and property
2. Increase public awareness
3. Increase knowledge

Suggested changes: None at this time

Wind River Reservation Goals

1. Minimize future structural and non-structural damage from natural disaster
2. Reduce threats to public health and safety
3. Promote education and training on reservation hazards

Suggested changes: None at this time

State of Wyoming Goals

1. Strengthen Public Infrastructure.
2. Improving State and Local Mitigation Capabilities.
3. Reduce Economic Losses due to Hazard Events.
4. Reduce State and Local Cost of Response and Recovery.

Jeff asked the group to consider their goals and if there was any suggested revision from the group. At the time of the presentation, there were no suggestions. Sam Bixler asked if the group could be provided with a list of federal resources used for funding, and Jeff said he would provide that to them.

Jeff also reviewed the hazard mitigation actions for each county from the previous plan: 49 in Fremont, 29 in Sublette, 26 in Wind River Reservation. Jeff explained that Wood will need a progress update on each action, one new action per jurisdiction, and more actions for higher level risk hazards. Then Jeff briefly reviewed the results of the public survey with the group, which indicate that the public believes that water conservation should be the number one priority for mitigation actions in the new plan.

Next steps

Jeff summarized the next steps in the process. Wood will finalize the HIRA and share with CPT in the next few weeks. Jeff then discussed the upcoming tasks for the CPT:

- Please return plan update guide input where outstanding
- Provide input on mitigation action status on form
- Start thinking of ideas for new mitigation actions
- Stay informed by email of upcoming meetings (July TBD)
- Review results public survey results
- Review draft HIRA section of plan when available
 - o For yellow highlighted gaps where applicable
 - o Review for jurisdiction specifics, mitigation ideas

The next round of CPT planning meetings will be held in July/August. Jeff emphasized that this is an important meeting and will form the basis for the updated mitigation

action plan. The meeting materials will also be shared electronically, including the presentation.

Chat Log:

09:23:30 From Amy Carr - Wood E&IS to Everyone:

Amy Carr, Deputy PM/Hazard Mitigation Planner, Wood

09:23:48 From Christopher Johnson to Everyone:

Christopher Johnson, Hazard Mitigation Planner/GIS Analyst, Wood

09:24:19 From Jim Mitchell Sublette EM to Amy Carr - Wood E&IS(Direct Message):

just for your record Harvey Spoonhunter EM for Northern Arapahoe

09:28:28 From natalie.schoen to Everyone:

Natalie Schoen, Hazard Mitigation Planner, Wood

09:39:39 From Abram Pearce to Everyone:

Abram Pearce - Director of Public Works, Town of Pinedale

09:41:34 From Sam Bixler to Everyone:

Sam Bixler, Marbleton

10:43:27 From Amy Carr - Wood E&IS to Everyone:

slido.com Code #R5

11:03:48 From Amy Carr - Wood E&IS to Everyone:

Thanks everyone!

Summary of the Wyoming Region 5 Multi-Hazard Mitigation Plan Update

Risk Assessment and Goals Meetings

Fremont County

June 9, 2022

Introductions and Opening Remarks

Jeff Brislawn, Project Manager, and Amy Carr, Deputy Project Manager, with Wood Environment & Infrastructure Solutions Inc., the consulting firm hired by WOHS to facilitate the plan update process, began the meetings with welcoming remarks. Emergency Management Coordinators from Fremont County, as well as members of the county's participating jurisdictions, attended the meeting. A goals update, a hazard risk significance summary overview, and a capability assessment update were covered during the meeting. This is the second of two gatherings to cover the risk assessment and goals for the planning process for the planning area.

June 9 Fremont County
1:00 pm – 3:00 pm
Attendees: 9

Attendance:

Chris Johnson	Town of Lander	Fire Administrator
Gary Hamlin	School District #7	Facilities Coordinator
Kathy Osborne	Fremont County	Emergency Management Admin. Assistant
Mike Harmon	High Plains Power	
Seth Wittke	Wyoming Geological Survey	
Vonda Huish	Fremont County	Emergency Management Coordinator
Jeff Brislawn	Wood	Project Manager
Amy Carr	Wood	Deputy Project Manager
Natalie Schoen	Wood	Hazard Mitigation Planner

Review of the Hazard Mitigation Planning Process

A PowerPoint presentation was presented by Jeff Brislawn and Amy Carr with Wood. Jeff started the meeting by outlining the FEMA nine-step planning process and discussed the project status, now in step 5. The online public survey was successful in engaging the community and has received a total of 98 responses. These responses indicate that community members perceive the highest risk hazards as drought, wind, winter storm, wildfire, and extreme cold.

Jeff noted that the 5-year update is required to maintain eligibility for FEMA Hazard Mitigation Assistance Grants; funding is increasing nationally for mitigation with the new Building Resilient Infrastructure and Communities (BRIC) grant, and that jurisdiction participation and input will be increasingly important as we move forward in the planning process.

Review of Hazards and Vulnerability Assessment Update

Jeff outlined the general risk assessment requirements before beginning a detailed discussion of each hazard. He presented details on each hazard that will be included in the draft updated risk assessment chapter. Refer to the Risk Assessment PowerPoint presentation and draft update of the Hazard Identification and Risk Assessment (HIRA - forthcoming) chapter for specific details on each hazard.

Several valuable details were learned during the risk assessment conversation among participants. Highlights of the discussions are noted by hazard in the tables below.

Hazard or Topic	Meeting Discussion
Avalanche	• Fremont and Wind River Reservation rated as low risk; Sublette is rated as medium • Jeff explained that WY has the 6th highest number of recorded avalanche fatalities. A majority occur in Teton counties, but WY Region 5 has backcountry activities in the wintertime so there is risk in the planning area • Vonda Huish, the Fremont EM, suggested to change hazard risk ranking for Fremont from low to medium due to the increase in number of backcountry visitors in areas where an avalanche could occur.
Dam Failure	• Fremont and Sublette listed as medium risk; Wind River Reservation rates as high • Jeff explained that some dams might not meet the criteria to get on the engineers list, but they will be included in the plan. Jeff also explained that the rating system does not consider the condition of the dam when determining risk • Jeff noted that only publicly available data can be used in the plan for homeland security reasons • 15 high hazard dams in Fremont
Drought	• All three areas rated as high risk

	• Amy discussed how there has been 19 USDA Disaster Designations since 2012 in the area for drought, 17 of which were Fast Track Designations, which indicates the drought was very severe in the region • Crops/vegetation and recreation/tourism are vulnerable to drought, as well as the regional water supply
Earthquake	• All three areas rated as medium risk • Fremont County is 6th highest in the State for earthquake losses and Sublette County is 8th highest in the State • HAZUS and USGS probabilistic seismic hazard maps • Cascading hazards such as landslide, rockfall, liquefaction, and fire • No additional comments from the group
Expansive Soils	• All three areas rated as low risk • Lander area is vulnerable to expansive soils in Fremont County • Poses a threat to roads and other transportation infrastructure, which compose the greatest number of critical facilities in Fremont
Extreme Cold	• All three areas rated as low risk • Amy Carr reviewed the 20 extreme cold events between 1996-2020 • Impacts from extreme cold lead to cascading events such as frozen pipes • Crops are very vulnerable, the USDA notes 3,000+ acres lost due to extreme cold in the region (all events were noted in Fremont)
Flood	• Fremont and Wind River Reservation rated high risk; Sublette rated as medium risk • 40 flood events in Fremont County since 1998 • 12 flood events in Wind River Reservation and a Presidential Disaster Declaration for flooding in 2017 • FEMA flood mapping and HAZUS data used for risk analysis (1% and 0.2% annual chance) • Transportation facilities are at high risk of flooding, especially bridges. It was noted that Fremont's largest number of critical facilities are transportation • Data used for the flood risk maps were derived from Hazus (100-year floodplain) and FEMA annual chance flood maps
Hail	• All three areas rated as medium risk • Hail is generally associated with summer storms and is a prevalent hazard in Region 5, with 110 events since 1955 • 12 events with 1.75-inch hail (golf ball size) in the region • Amy reviewed several notable events in the region that resulted in significant damages and discussed vulnerabilities to hail, such as outdoor workers, livestock and crops, and outdoor property • Vonda noted that she has not seen any hail events with exceedingly large sized hail in recent years in Fremont
High Wind and Downbursts	• All three areas rated as medium risk • High wind has a constant presence in Wyoming and the Region has experienced 340 high wind events (occurs generally in the winter months and has average higher wind speeds) and 128

	thunderstorm events (occurs in summer months along with thunderstorms and has generally lower wind speeds) • A significant portion of the reported high wind events in the planning area occurred in Fremont County • Amy explained how wind has caused significant damages in the region and discussed the notable events
Landslide/Rockfall/Debris Flow	• All three areas rated as medium risk • Jeff explained these hazards are most likely to happen on/near steep terrain • Roads such as forest service roads and railroads are at risk, especially in the Wind River Valley • In Fremont County, Highway US-26/287 is vulnerable to landslides, rockfall, and debris flow • There was a comment regarding a rockfall on Hwy 20 that closed it temporarily in May 2022 near the tunnel just north of Boysen Reservoir. The location of the border between Fremont and Hot Springs counties and possibly the Wind River Reservation
Lightning	• All three areas rated as high risk • Amy highlighted the 8 recorded lightning events in the region since 1969, one of which caused a fatality • Amy discussed the vulnerabilities to lightning, including outdoor enthusiasts and electricity-dependent people and operations • It was noted that events have killed livestock in Fremont County
Mine Subsidence	• All three areas rated as low risk • Jeff explained that property and infrastructure damage are associated with mine subsidence in WY communities, but dollar amount isn't available. It is best to avoid placing new development in these areas • A comment noted that there is a closed uranium mine near Jeffrey City on the south side of Green Mtn.
Tornado	• All three areas rated as low risk • Amy discussed the 26 events that have occurred in the region since 1950 and the notable events that have occurred in the area • Communication systems and equipment are vulnerable to tornado events • 97% of reported property damages from tornado events occurred in Fremont County • No comments from the group
Severe Winter Weather	• All three areas are rated as high risk • Jeff discussed the high number of past winter storms events in the region and the various vulnerabilities to winter weather, such as possible isolation from road closures
Wildfire	• All three areas rated as high risk • Two federal disaster declarations: Roosevelt Fire 2018 (Sublette) and Lava Mountain Fire 2016 (Fremont) • Kates Basin Fire 2000 burned significant portion of Wind River Reservation • Highest wildfire risk near WUI and highly populated areas

	- Increasing temperatures, prolonged drought, and greater winds overlapping with fire season creates higher risk for wildfire - It was noted that wildfire risk is significant, with highest risk areas surrounding the towns of Riverton, Hudson, and Lander
HazMat	- All three areas rated as low risk - Amy reviewed the 648 hazardous material incidents since 1990, which can happen at a facility, during transportation, or at the storage site. - There are 9 Risk Management Plan Facilities in the region, 5 in Fremont and 4 in Sublette

Amy ended this section of the presentation by asking the group what ratings should be changed, and what should the new ratings be. Vonda Huish, the Emergency Management Coordinator with Fremont County, and Kathy Osborne, the Emergency Management Admin. Assistant, suggested changing the risk rating of Avalanche from "low" to "medium" for Fremont County. They noted that this change is due to many tourists and outdoor enthusiasts visiting areas in the county that could experience an avalanche. Jeff informed the group that if these ratings are raised, mitigation actions will need to be added to the plan associated with the higher risk hazards. The rating on landslide may also be revisited by Fremont County EM, who was contemplating increasing it to high.

Capability Assessment Update

Jeff briefly reviewed highlights of existing capabilities in the county to mitigate hazards. He explained that this information came from the Plan Update Guides that were sent out, and ideally every jurisdiction would return one so all the information in the HMP is current. The counties noted the following about capabilities and Jeff asked the group to consider what opportunities there are to improve them. Vonda said that the Planning Department should review and that she would followup with them. The group did not note any additional capabilities beyond what was on the slide aside from a comment that County EM was working on the THIRA update. There was a comment that staff recruitment and retention had been a challenge following COVID Pandemic. A limited regulatory sentiment in the county has been prevented zoning or building codes from being adopted.

Fremont County	- County Land Use Plan 2004 - City of Lander Master Plan 2012 - County Subdivision Regulations - County Community Wildfire Protection Plan 2012 and 2014 update - Fuel reduction activities - County Drought Task Force - LEPC - Firewise efforts - County and municipal participation in NFIP
Sublette County	County Comprehensive Plan includes Natural Hazards

	• Zoning, Land use and development regulations • Burn bans • Big Piney and County participation in NFIP • Pinedale Drainage Study and 5-year Plan 2010 • County Community Wildfire Protection Plan 2006 and 2016. (Updating in 2022) • Fuel reduction activities • Firewise Assessments • Haz Mat evacuation plans
Wind River Reservation	• Wind River Reservation Land Use and Development Plan • Zoning and Subdivision Ordinance • Floodplain Ordinance • Building Codes • Community Evacuation Plans • Lightning Detectors in Public Areas • Partnerships with Fremont County and Rural Fire Protection Districts • Wind River Water Code • Agricultural Resource Management Plan 2018 • Drought Adaption Plan

Mitigation Strategy Update

The CPT Reviewed a list of typical goal statements for hazard mitigation plans, drawn from their existing plans other county plans in the region, and the Wyoming State Hazard Mitigation Plan. The counties in the region were asked to review their specific goals and consider changes.

Fremont County Goals

1. Protect life and property from hazard impacts
2. Increase public awareness of hazards
3. Protect natural systems from hazard impacts
4. Strengthen partnerships related to hazard mitigation
5. Enhance emergency services and reduce impacts to critical infrastructure

Suggested changes: The group felt that they were still valid and did not suggest any changes.

Sublette County Goals

1. Protect life and property
2. Increase public awareness
3. Increase knowledge

Suggested changes: None at this time

Wind River Reservation Goals

1. Minimize future structural and non-structural damage from natural disaster
2. Reduce threats to public health and safety
3. Promote education and training on reservation hazards

Suggested changes: None at this time

State of Wyoming Goals

1. Strengthen Public Infrastructure.
2. Improving State and Local Mitigation Capabilities.
3. Reduce Economic Losses due to Hazard Events.
4. Reduce State and Local Cost of Response and Recovery.

Jeff asked the group to consider their goals and if there was any suggested revision from the group. At the time of the presentation, there were no suggestions.

Jeff also reviewed the hazard mitigation actions for each county from the previous plan: 49 in Fremont, 29 in Sublette, 26 in Wind River Reservation. Jeff explained that Wood will need a progress update on each action, one new action per jurisdiction, and more actions for higher level risk hazards. Then Jeff briefly reviewed the results of the public survey with the group, which indicate that the public believes that water conservation should be the number one priority for mitigation actions in the new plan.

Next steps

Jeff summarized the next steps in the process. Wood will finalize the HIRA and share with CPT in the next few weeks. Jeff then discussed the upcoming tasks for the CPT:

- Please return plan update guide input where outstanding
- Provide input on mitigation action status on form
- Start thinking of ideas for new mitigation actions
- Stay informed by email of upcoming meetings (July TBD)
- Review results public survey results
- Review draft HIRA section of plan when available
 - o For yellow highlighted gaps where applicable
 - o Review for jurisdiction specifics, mitigation ideas

The next round of CPT planning meetings were originally going to be held in late June or July, but with the delay in Meeting #2, that timeframe may be pushed back. The counties and jurisdictions will receive an email from Wood to inform them of the date for the next

meeting. Jeff emphasized that this is an important meeting and will form the basis for the updated mitigation action plan. The meeting materials will also be shared electronically, including the presentation.

Chat log:

12:57:05 From Gary Hamlin to Everyone:
Gary Hamlin

12:57:17 From Fremont County to Everyone:
Kathy Osborne Fremont County EMA

12:57:21 From Gary Hamlin to Everyone:
Facilities coordinator, FCSD#6

12:57:25 From Jeff Brislawn, Wood to Everyone:
Hello everyone. Please type your name, title and affiliation here in the Chat log as our attendance record.

12:57:52 From Jeff Brislawn, Wood to Everyone:
Jeff Brislawn, Project Manager, Wood Environment & Infrastructure Solutions, Inc.

12:57:54 From Christopher Johnson to Everyone:
Chris Johnson, City of Lander Fire Administrator

12:58:35 From vonda.huish to Everyone:
Vonda Huish, Coordinator, FCEMA

13:00:03 From Amy Carr - Wood to Everyone:
Amy Carr, Deputy Project Manager, Wood Environment and Infrastructure Solutions, Inc.

13:02:28 From natalie.schoen to Everyone:
Natalie Schoen, Hazard Mitigation Planner, Wood

13:03:11 From Mike Harmon to Everyone:
Mike Harmon, High Plains Power

13:03:14 From Seth Wittke, WSGS to Everyone:
Seth Wittke, Geologist, Wyoming Geological Survey

14:31:05 From Gary Hamlin to Everyone:
Vonda, can you get me the guides mentioned here, I'm hoping to develop a plan for our district.

14:31:53 From vonda.huish to Everyone:
Absolutely, we will do so after this meeting.

14:32:07 From Gary Hamlin to Everyone:
Thank you!

14:34:16 From Jeff Brislawn, Wood to Everyone:
Gary can you provide the name of your district?

14:34:37 From Gary Hamlin to Everyone:
Fremont County School District #6

14:34:49 From Gary Hamlin to Everyone:
ghamlin@fre6.k12.wy.us

14:53:59 From Gary Hamlin to Everyone:
Thank yu everybody, some great info here.

14:54:00 From Amy Carr - Wood to Everyone:
Thanks for attending everyone!

From: [Fremont County EMA](#)
To: "City of Lander Airport Fire Hall Manager"; duboispw@wyoming.com; "Eric Murphy"; [Kathy Shoopman](#); kbutterfield@rivertonwy.gov; [Lance Hopkin](#); "Mike Franchini"; [Monte Richardson](#); rfdfirefighter51@gmail.com; rgard@rivertonwy.gov; rsfossen@landerwyoming.org; speters@landerwyoming.org; "Town of Dubois"; "Town of Hudson"; "Town of Pavillion"; "Town Of Shoshoni"; "Town of Shoshoni PD"
Cc: vonda.huish@fremontcountyywy.gov; [Brislaw, Jeff P](#); [Carr, Amy](#); [Kathy Osborne](#)
Subject: URGENT!!! Final R5 Mitigation Planning Meeting
Date: Friday, August 5, 2022 8:09:19 AM
Attachments: [R5 HMP Update Guide Worksheet EMA 060322.docx](#)
[R5 MIT Action Status Tracker 062822.xlsx](#)
Importance: High

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Dear Stakeholders,

NOTE: If you **DO NOT** participate in the Region 5 (this includes Fremont County) Hazard Mitigation Plan updating, **YOU WILL NOT BE ELIGIBLE** for FEMA Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) and/or Flood Mitigation Assistance (FMA) funding until the next plan updating cycle **IN 5 YEARS. DEADLINE IS AUGUST 12, 2022 FOR THE ATTACHED DOCUMENTS TO BE RETURNED.**

As a reminder, prior to the upcoming final meeting on the Hazard Mitigation Plan update, please return the Mitigation Action Tracker and Plan Update Guides by August 12. This will allow us to begin the meeting with an understanding of progress on mitigation actions, and which actions still need to be accomplished and carried forward in the plan update. It will also allow us to focus on developing new mitigation actions that may be needed.

It is imperative that jurisdictions that wish to fully participate in the plan, and ultimately re-adopt it, be represented at the meeting, and return requested information. As a reminder participation is defined as:

- Attend and participate in planning meetings/workshops
- Provide available data requested of the County and Tribal coordinator and Wood
- Provide input on local mitigation strategy (actions/projects)
- Advertise and assist with public input process
- Review and comment on draft plan
- Coordinate formal adoption

Kathy Osborne

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Wyoming Region 5

Hazard Mitigation Plan Update Meeting #3

Mitigation Strategy Workshop Agenda

Date: Thursday, August 18, 2022
1:00pm – 3:00 pm MST

Meeting at: Zoom Meeting
<https://us02web.zoom.us/j/84466398415?pwd=b1ova29kWiZweXIKd05VL3dRbTRDQT09>
+1 346 248 7799
Meeting ID: 844 6639 8415
Passcode: 301810

Subject/Purpose: The purpose of this meeting is to review the planning process so far, then modify, add, and/or delete mitigation actions and projects applicable to Sublette and Fremont Counties based on the Hazard Mitigation Planning Committee input and pertinent plan goals.

Attendees: Fremont County Planning Team, Sublette County Planning Team and Stakeholders

1. Introductions
2. Review of the planning process and progress to date
3. Update mitigation goals & objectives
4. Review of progress on mitigation actions from 2017 plan
5. Review of mitigation action categories
6. Development of new mitigation actions
7. Discuss next steps
8. Questions and answers/adjourn

Wyoming Region 5 Hazard Mitigation Plan Fremont and Sublette Counties 2022 Regional Hazard Mitigation Plan Update

Mitigation Strategy Meeting Summary

August 18, 2022, 1:00 – 3:00 pm

Introductions

Amy Carr, Deputy Project Manager, Wood Environment and Infrastructure Solutions (Wood) kicked off the virtual meeting and thanked everyone for their participation. Amy introduced the Wood team and asked all attendees to type their name, jurisdiction, and title in the chat for attendance keeping purposes. In total 15 individuals participated in the online webinar, with 3 additional attendees in person, representing the consultant team and Fremont and Sublette Counties, as well as special districts, stakeholders, and partner organizations. A separate meeting covering the same topics will be held for the Wind River Reservation.

Review of the Planning Process

The FEMA planning process steps were recapped; Wood is currently wrapping up the Risk Assessment process and beginning the mitigation strategy portion. This virtual meeting addressed mitigation strategizing and revisions/refinements to the goals of the participating jurisdictions.

The progress on the plan update process to date was reviewed. Highlights include:

- Kickoff meeting held February 17th
- Risk Assessment meeting for Fremont County held May 19th
- Risk Assessment meeting for Sublette County and the Wind River Reservation held June 8th
- Online Public Survey conducted - Closed May 18th
- HIRA Draft update will out for HMPC review in September

Mitigation Goals

The goals from the 2017 Hazard Mitigation Plan were revisited. Key differences between “goals,” “objectives” and “actions” were defined:

Goals are general guidelines that explain what you want to achieve. Goals are defined before considering how to accomplish them so that the goals are not dependent on the means of achievement. They are usually broad policy-type statements, long term, and represent global visions, such as:

- Reduce exposure to hazard related losses
- Minimize the risk from natural disasters to existing facilities and proposed development.
- Reduce the impact of natural hazards to the citizens of the county.
- Provide protection for natural resources from hazard impacts
- Maintain and enhance existing mitigation measures.

- Increase public awareness of vulnerability to hazards and support and demand for hazard mitigation

Projects submitted for grant funding will need to tie back to goals and objectives in the HMP.

The 2022 Wyoming Region 5 Hazard Mitigation Plan goals for the counties are as follows; the group thought that they still were valid and comprehensive and did not suggest any changes.

Fremont County:

- Goal 1: Protect life and property from hazard impacts.
- Goal 2: Increase public awareness of hazards.
- Goal 3: Protect natural systems from hazard impacts.
- Goal 4: Strengthen partnerships related to hazard mitigation.
- Goal 5: Enhance emergency services and reduce impacts to critical infrastructure.

Sublette County:

- Goal 1: Protect life and property, implement activities that will protect lives and reduce property loss which may occur as a result of natural or man-made hazards.
- Goal 2: Increase public awareness, provide resources for outreach and education programs to increase public awareness of risks associated with natural and man-made hazards.
- Goal 3: Increase knowledge, gather information necessary to assess and develop plans to avoid and respond to risks and events associated with natural and man-made hazards.

Review of Progress on Existing Mitigation Actions

Prior to the webinar, a Mitigation Action Tracker was sent to the HMPC listing each jurisdiction's 2017 mitigation actions. Each HMPC representative was asked to provide status to provide comments on the status of each action. The Tracker was discussed during the webinar to fill in some of the missing statuses. The mitigation action statuses are categorized as one of the following: Completed, Annual Implementation, In Progress, Not Started, and Deleted.

Some examples of "Deleted" actions may be due to lack of project applicability over time, or even inability to complete a project in an area where the community does not have control/jurisdiction (e.g., state owned vs. federal land). Annual Implementation are actions that a jurisdiction is conducting on an ongoing basis, but which the jurisdiction wants to continue forward into the updated plan to maintain visibility on the action.

Amy went through the Mitigation Action Tracker status spreadsheet with the group in the meeting to fill in some of the missing information gaps. Updated statuses of an several actions were provided during this exercise for both counties; Fremont County will need to follow up on several actions, some related to the County and others related to Dubois and Pavillion. A representative from Lander also noted that they will need to further discuss the status of the action related to wildfire regulations. Some Sublette County actions and actions specific to Pinedale and Big Piney will need follow up. Wood will send a version of the Mitigation Action Tracker revised based on the meeting input following the meeting.

Review of Mitigation Action Categories

Amy Carr led a discussion on what FEMA considers to be mitigation, with several examples on specific categories of actions that the jurisdictions could pursue. One way to think of mitigation actions is the four A's:

- Altering a hazard,
- Averting a hazard,
- Avoiding a hazard,
- Adapting to a hazard

FEMA suggests these four categories for mitigation actions:

- Plans and Regulations,
- Structure and Infrastructure Projects,
- Education and Awareness, and
- Natural Systems Protection.

Resources for more details on mitigation action types, categories, and example projects were provided, including a short discussion on climate change and adaptation considerations. Example hazard-specific mitigation projects were discussed including FEMA funding-eligible projects for drought/extreme heat, winter storm, flooding, and other hazards. Region 5 has leveraged FEMA mitigation funding, including the Hoback Ranches Special Improvement District award of HMGP-Post Fire funding for culvert improvements (which has thus far helped manage post-fire flood flows), and an Advance Assistance award to Lander for a flood mitigation feasibility study.

Developing New Mitigation Actions

Each participating jurisdiction is required to develop at least one new action for the 2022 plan update.

Ideally, jurisdictions should develop actions that address all the hazards addressed in the plan, or at least the High significance hazards. All jurisdictions that participate in the National Flood Insurance Program (NFIP) will need to have a mitigation action addressing continued NFIP compliance.

The following are resources with ideas and examples of mitigation actions and implementation:

- FEMA's Mitigation Idea: <https://www.fema.gov/media-library/assets/documents/30627>
- Colorado Planning for Hazards Guide: <https://planningforhazards.com/home>

2022 Hazard Summary

The Hazard Summary table was briefly reviewed. The group then reviewed the risk summary rankings by jurisdictions. The HMPC will also have an additional opportunity to review the overall significance of each hazard and provide comments while reviewing the draft HIRA.

Public Survey Results

In total 98 responses were received in the public survey. Of the respondents 87 live in Fremont County, 3 in Sublette County, and 8 on the Wind River Reservation. 87 persons noted living in community for over 10 years. The top five hazards of concern based on this public survey were:

- Drought
- Wind
- Winter Storm
- Wildfire
- Extreme Cold

The final question reviewed was asking the public to indicate the types of mitigation actions that they think should have the highest priority in the plan update. The top five actions indicated by the public were:

- Water Conservation
- Improved reliability of communication systems
- Public Education/Awareness
- Wildfire Fuels Treatment Projects
- Generators for Critical Facilities

The survey results will be emailed to the HMPC after the meeting. The HMPC and stakeholders were encouraged to review the survey results and take them into account when developing new mitigation actions.

New Mitigation Action Ideas

A link to the New Mitigation Action Form designed to capture necessary details on actions was shared during the meeting and will be emailed afterwards. Each HMPC member was asked to fill out the survey with at least one mitigation action by September 19th.

A discussion was held regarding potential new actions. Ideas included:

- Hudson Flood Mitigation: Further exploration and development of flood mitigation options. The Town has been working with the ACOE, with support from FEMA and WOHS, on possible flood mitigation options. The Union Pacific Railroad and Wind River Reservation will also be stakeholders.
- Hudson Water Tower and Ditch Protection: Flooding and erosion is affecting the ditch infrastructure and could lead to compromising the water tower.
- Hudson Communications Infrastructure Improvement: The Town has spotty internet, and this could lead to shortcomings in alert and warning.
- Hoback Ranches Road Improvement and Landslide Mitigation: Landslides are a potential hazard that could compromise the only ingress and egress on the east end.

Link to New Mitigation Actions Form: <https://forms.office.com/r/FKhZUb1utE>

Next Steps

The next steps in the HMP update process were briefly discussed and the project milestones and prospective timeline for task completions were presented.

<u>Project Milestone</u>	<u>Anticipated Timeline</u>
• HMPC Review Draft	October
• Public Review Draft	November
• Wyoming OHS Review	December
• FEMA Review (estimated)	January 2023
• Final Approved HMP for local adoption	January-February 20223

Questions and Answers/Adjourn

The webinar adjourned around 3:00 pm.

Points of Contact for this HMP update effort:

Jeff Brislawn

Wood E&IS Project Manager
Jeff.brislawn@woodplc.com
 303-704-5506

Amy Carr

Wood E&IS Deputy Project Manager
amy.carr@woodplc.com
 240-393-5425

Vonda Huish

Fremont County - Emergency Management Coordinator
fcema@fremontcountyny.gov

Jim Mitchell

Sublette County – Emergency Management Coordinator
jmitchell@subso.com

Meeting Chat Log:

00:12:18 Shamika McDonald, Wy SHMO: Shamika McDonald, State Hazard Mitigation Officer Wyoming Homeland Security

00:12:34 Deb Smith: Deb Smith, Superintendent, Fremont Co Sch Dist 21, Fort Washakie
 00:12:37 Christopher Johnson: Chris Johnson, City of Lander, Fire Administrator
 00:12:57 Jim Mitchell: Sam Bixler Marbleton just showed up
 00:13:06 sschacht: Steve Schacht, Washakie District Ranger, Shoshone NF, Lander
 00:16:52 Jim Mitchell: Poll won't let me do multiple entries
 00:38:20 Jim Mitchell: we concur
 01:07:15 Jim Mitchell: Amy Carr, just making sure you have both of these Sam's contact information...
 01:08:31 Josh Hedden: I have to jump off for another meeting. Thanks for having me
 01:09:25 Christopher Johnson: Hi Jim, I have both Sam's names and titles in our meeting notes
 01:34:55 Christopher Johnson: <https://forms.office.com/r/FKhzUb1utE>
 01:35:18 Christopher Johnson: https://www.fema.gov/sites/default/files/2020-08/fema_mitigation-action-portfolio-support-document_08-01-2020_0.pdf
 01:35:39 Christopher Johnson: ^here is a link again to the FEMA Mitigation Action Portfolio for reference
 01:39:27 Jim Mitchell: will you send out the slide deck for this presentation?
 01:42:26 Amy Carr - Wood: Yes, we'll share the slide deck, meeting summary, and recording following the meeting.
 01:43:56 Jim Mitchell: I was promised the Draft of the CWPP, but it is still not ready. when it does get to me, I will forward to Team Wood.
 01:50:03 Jim Mitchell: Understood

From: [FC Emergency Mgt](#)
To: ["Ada Kaser"; "Andy Frey"; "Beth Walsh"; "Billy Meeks"; "Bob Fenton"; "Bobby Johnson"; "Brian Hutchins"; "Chemtrade 2"; "Chemtrade 3"; "Chemtrade 4"; "Chris Jones"; "City of Lander Airport Fire Hall Manager"; "Clint Glick"; "Clyde Young"; "Cody Beers"; "Craig Haslam"; "Curtis Moffat"; "Dan Oakley"; "David Stringham"; "Devon Gonzalez"; "Diane Lane"; "Enden Nelson"; "Eric Murphy"; "Erin Ivie"; "Ernie Over"; "Forrest Viktonn"; "Gary Michaud"; "Harvey Spoonhunter"; "Jason Hunzie"; "Jason Laird"; "Jeffrey City VFD"; "Jill Johnson"; "Jim Pilon"; "Kathy Osborne"; "Larry Allen"; "Larry DeGraw"; "Lloyd Larsen"; "Matt Lee"; "Michael Harmon"; "Mike Franchini"; "Mike Hutchison"; "Penny Robertson"; "Rick Johnson"; "Rita Gatlin"; "Ron Wempen"; "Russell Grauberger"; "Ryan Lee"; "Scott Walters"; \[speters@landerwyoming.org\]\(mailto:speters@landerwyoming.org\); "Stephanie Munoz"; "Todd Cox"; "Tom Wilkinson"; "Tony Simmers"; "Traci Foutz"; "Vonda Huish"; "Wes Romero"; "WY Highway Patrol"](#)
Subject: FW: Public Survey!

Good Morning All,

This is a survey for the Public. Please pass the link onto anyone in the public that you feel might be interested. We will be posting it to our county web site as well as our facebook page. We appreciate any assistance from you on getting it out to the public. Have a wonderful day and we look forward to seeing you at the next Region 5 Hazard Mitigation meeting.

Take our Survey on hazards!

Wyoming Region 5 (Fremont County, Sublette County, and the Wind River Reservation) is updating its Multi-Jurisdictional Hazard Mitigation Plan in 2022. The Hazard Mitigation Plan analyzes each county's and tribe's vulnerabilities to natural and human caused hazards and identifies mitigation actions that can be taken to minimize property damage and public safety risks. The purpose of this survey is to solicit public input on hazards of concern, and suggestions for reducing the impacts of hazards before they occur. The survey has 7 questions and only takes about 5 minutes.

The survey is open till April 25, 2022.

<https://forms.office.com/r/zkEPQHrWx7>

NOTE; Some of you may receive this email more than twice as you are in more than one email group.

Kathy Osborne

Administrative Assistant
Fremont County Emergency Management
818 S. Federal Blvd. Suite 200
Riverton WY 82501
307-856-2374 O
307-349-0957 C

From: [FC Emergency Mgt](#)
To: [Becky Enos](#); [Larry Allen](#); [Travis Becker](#); [Michael Jones](#); [Jennifer.mccarty@fremontcountywy.gov](#); [clarence.thomas@fremontcountywy.gov](#)
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Kathy Osborne

Administrative Assistant
Fremont County Emergency Management
818 S. Federal Blvd. Suite 200
Riverton WY 82501
307-856-2374 O
307-349-0957 C

From: FC Emergency Mgt
To: "Billy Meeks"; "Carl Freeman"; "Craig Haslam"; "Ernie Over"; fcema@fremontcountywy.gov; "Larry Allen"; "Ryan Lee"; sdwalters@wyoming.com; steve.baumann@fremontcountywy.gov; tara.berg@fremontcountywy.gov; blm_wy_Lander_wymail@blm.gov; "Chris Jones"; sschacht@fs.fed.us; "City of Lander Airport Fire Hall Manager"; duboisgw@wyoming.com; "Eric Murphy"; "Kathy Shoopman"; kbutterfield@rivertonwy.gov; lhopkins@landerwyoming.org; "Mike Franchini"; rfdfirefighter51@gmail.com; rgard@rivertonwy.gov; rsfossen@landerwyoming.org; speters@landerwyoming.org; "Town of Dubois"; "Town of Hudson"; "Town of Pavillion"; "Town Of Shoshoni"; "Town of Shoshoni PD"; "Andy Frey"; "Darick Eisenbraun"; "Diane Lane"; "Josh Hedden"; "Leslie Blythe"; "Michael Harmon"; bthoren@shoshonischools.org; cathy.meyer@wy.nacdn.net; community@windriver.org; dbarker@landerschools.org; dsmith@fortwashakieschool.com; FCAGovts@gmail.com; fremontfirewise@wyoming.com; "Jeffrey City VFD"; "JoAnn Flanagan"; "Kathy Gosnell"; midvale@wyoming.com; pacd.general@gmail.com; roy.brown@fremont38.com; ssplchal@fremont2.org; "Stephanie Zickefoose"; "Tony Zickefoose"; amalcolm@uwyo.edu; brian.russell@uwyo.gov; cmarsha1@uwyo.edu; cody.beers@wyo.gov; erin.campbell@wyo.gov; "Seth Wittke"; shamika.mcdonald1@wyo.gov
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Kathy Osborne

Administrative Assistant
Fremont County Emergency Management
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Riverton WY 82501
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City of Lander-Wyoming

34 mins · 🌐

Fremont County Emergency Management asks that you take this short Survey regarding hazards!

Wyoming Region 5 (Fremont County, Sublette County, and the Wind River Reservation) is updating its Multi-Jurisdictional Hazard Mitigation Plan in 2022. The Hazard Mitigation Plan analyzes each county's and tribe's vulnerabilities to natural and human caused hazards and identifies mitigation actions that can be taken to minimize property damage and public safety risks. The purpose of this survey is to solicit public input on hazards of concern, and suggestions for reducing the impacts of hazards before they occur. The survey has 7 questions and only takes about 5 minutes.

<https://forms.office.com/r/zkEPQHRWx7>

The survey is open till April 25, 2022.



Like



Comment



Share



Sublette County Emergency Management

April 28 at 3:24 PM

28 April 2022 1525 hrs

Take our Survey on hazards!

Wyoming Region 5 (Fremont County, Sublette County, and the Wind River Reservation) is updating its Multi-Jurisdictional Hazard Mitigation Plan in 2022. The Hazard Mitigation Plan analyzes each county's and tribe's vulnerabilities to natural and human caused hazards and identifies mitigation actions that can be taken to minimize property damage and public safety risks. The purpose of this survey is to solicit public input on hazards of concern, and suggestions for reducing the impacts of hazards before they occur. The survey has 7 questions and only takes about 5 minutes.

The survey is open till May 18th 2022.

<https://forms.office.com/r/zkEPQHrWx7>

Please share to local friends so we can see what your thoughts are.

FORMS.OFFICE.COM

Microsoft Forms



1

2 Comments

Wyoming Region 5 Hazard Mitigation Plan Public Input Survey

98

Responses

07:53

Average time to complete

Closed

Status

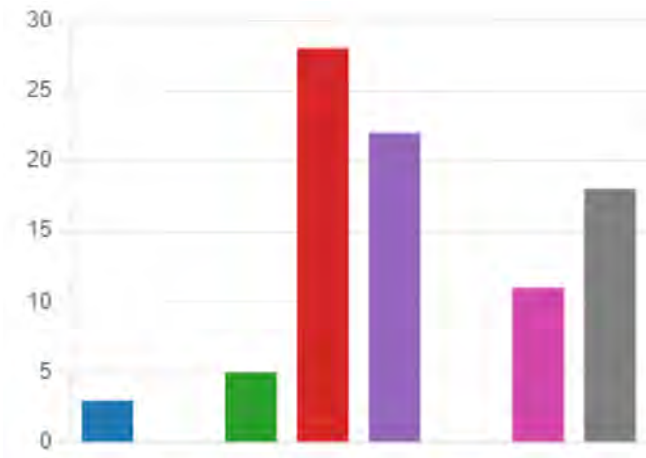
1. Where do you live? (If "other" please indicate where)

Fremont County	87
Sublette County	3
Wind River Reservation	8
Other	0



2. Which community in Fremont County do you live, work or represent?

Town of Dubois	3
Town of Shoshoni	0
Town of Hudson	5
Town of Pavillion	28
Town of Lander	22
City of Riverton	0
Unincorporated Fremont County	11
Other	18



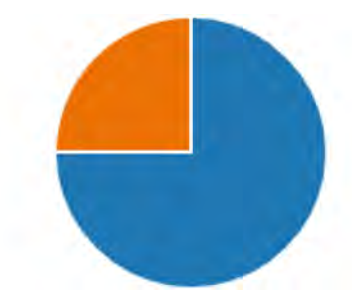
3. Which community in Sublette County do you live, work or represent?

● Town of Big Piney	0
● Town of Marbleton	0
● Town of Pinedale	1
● Unincorporated Sublette County	2



4. Which Tribe on the Wind River Reservation do you represent?

● Eastern Shoshone Tribe	6
● Northern Arapaho Tribe	2



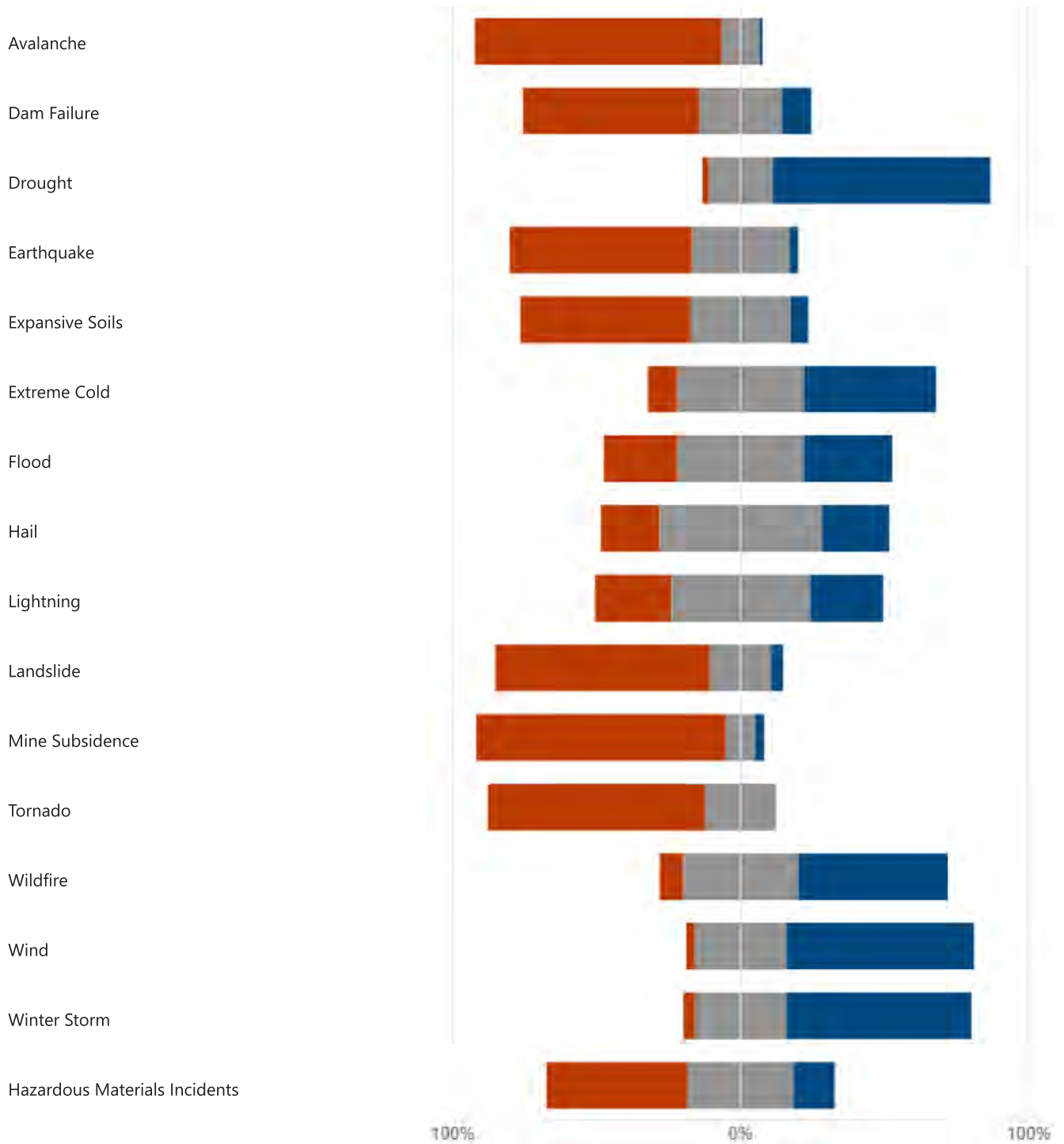
5. Which community on the Wind River Reservation do you live, work or represent? (If "other" is selected please state where)

● Arapaho/St Stephens	0
● Crowheart	2
● Ethete	1
● Fort Washakie	5
● Other	0



6. The hazards addressed in the Wyoming Region 5 Hazard Mitigation Plan update are listed below. Please indicate the level of significance in the County (Fremont or Sublette) you live in or on the Wind River Reservation you live on (Eastern Shoshone or Northern Arapaho Tribe) that you perceive for each hazard.

Low Medium High



7. Do you have information on specific hazard issues/problem areas that you would like the planning committee to consider? Note the jurisdiction (County, Reservation or Community) to which it applies:

49

Responses

Latest Responses

"Drought."

"As the population increases in Sublette, we currently in a housing co...

 Update

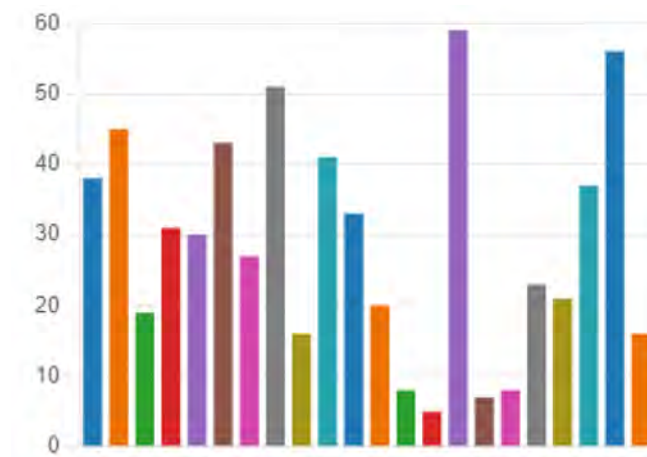
7 respondents (14%) answered **fires** for this question.



8. Mitigation is actions that can be taken to reduce or eliminate the long-term risk to hazards.

The following types of mitigation actions may be considered in Wyoming Region 5. Please indicate the types of mitigation actions that you think should have the highest priority in the Wyoming Region 5 Hazard Mitigation Plan.

Indoor/Outdoor Warning	38
Wildfire Fuels Treatment projects	45
Assistance with Defensible Space	19
Continued Participation in the N...	31
Critical Facilities Protection	30
Generators for Critical Facilities	43
Planning/Zoning	27
Public Education/Awareness	51
Stormwater Drainage Improvem...	16
Forest Health/Watershed Protec...	41
Flood Mitigation	33
Education and Discounts on Flo...	20
Floodprone Property Buyout	8
Avalanche Mitigation	5
Water Conservation	59
Landslide/mudslide mitigation	7
Rockfall mitigation	8
Evacuation route development	23
Dam safety	21
Public health incident prepared...	37
Improve reliability of communic...	56
Lightning protection for critical f...	16



9. Please comment on any other pre-disaster strategies that the planning committee should consider for reducing future losses caused by natural disasters:

35
Responses

Latest Responses
"None come to mind"

[↻ Update](#)

6 respondents (17%) answered **needs** for this question.



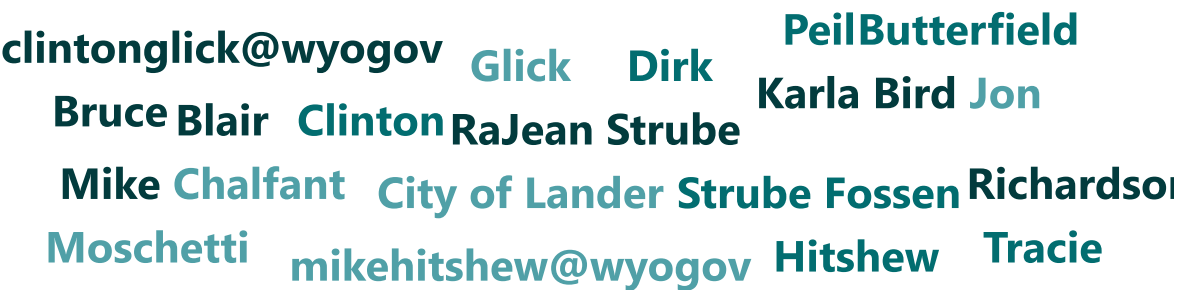
10. Optional: Provide your name and email address if you would like to be added to a distribution list for upcoming activities related to the planning process:

27
Responses

Latest Responses
"Karla Bird frankorkarlabird@hotmail.com"
"thanks"

[↻ Update](#)

1 respondents (4%) answered **RaJean Strube** for this question.



APPENDIX B: PLAN ADOPTION AND APPROVAL

Note: The records of adoption will be incorporated as an electronic appendix. When the plan is adopted in 2023, the adoption date will be noted here, but a scanned version of the adoption resolution will be kept on file with the Emergency Manager of each participating county in Wyoming Region 5. A sample adoption resolution is provided here. The final FEMA approval packet will be included for future reference regarding the five-year expiration date and suggestions for improvement in the next update.

Mitigation Plan Adoption Sample Resolution

Resolution # _____

**Adopting the 2023 Wyoming Region 5
Hazard Mitigation Plan**

Whereas, (name of county or community) recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, an adopted Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, (name of county or community) resides within the Planning Area, and fully participated in the mitigation planning process to prepare this Hazard Mitigation Plan; and

Whereas, the Wyoming Office of Homeland Security and Federal Emergency Management Agency, Region VIII officials have reviewed the 2023 Wyoming Region 5 Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body; and

Now, therefore, be it resolved, that the (name of board or council), hereby adopts the Wyoming Region 5 Hazard Mitigation Plan, as an official plan; and

Be it further resolved, the (name of county or community) will submit this Adoption Resolution to the Wyoming Office of Homeland Security and Federal Emergency Management Agency, Region VIII officials to enable the Plan's final approval.

Passed: (date)

Certifying Official

Appendix B: Adoption Resolutions and Plan Approval

Wyoming Region 5
Hazard Mitigation Plan

2023-2028

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Passed: (date)

Certifying Official

2000 S. Colorado Boulevard, Suite 2-1000
Denver, CO 80222